Journal of the Society of Arts.

FRIDAY, JANUARY 19, 1866.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings, at Eight o'clock:—

JANUARY 24.—"On the Uses of National Museums to Local Institutions." By Lord HENRY G. LENNOX, M.P. On this evening A. H. LAYARD, Esq., M.P., will preside.

JANUARY 31.—"Dwellings for the People; how to Multiply and how to Improve them." By THOMAS BEGGS, Esq.

INSTITUTIONS.

The following Institutions have been received into Union since the last announcement:—

Freetown (Glossop) Working Men's Institute.
Lambeth Evening Classes, Hercules-buildings, Lambeth, S.
Plymouth Wesleyan Institution.
Wallingford Mechanics' Institution.

CANTOR LECTURES.

The concluding Lecture of the Course, by G. W. HASTINGS, Esq., LL.D., will be delivered as follows:—

LECTURE IV.—MONDAY, JANUARY 22ND.—"On Limited Liability."

The Course of Lectures "On Submarine Telegraphy," by Fleeming Jenkin, Esq., F.R.S., will commence on Monday, January 29th.

The lectures commence each evening at Eight o'clock, and are open to Members, each of whom has the privilege of introducing ONE Friend to each Lecture.

Tickets for Mr. Fleeming Jenkin's Course, for friends of Members, will be issued with next week's *Journal*.

PARIS UNIVERSAL EXHIBITION OF 1867.

Forms of application for space, and copies of the regulations, may be had on application to the Secretary of the Society of Arts, and should be applied for without delay.

Although the 28th February, 1866, has been fixed as the last day for receiving demands for space, intending Exhibitors are requested not to delay forwarding such demands, but to send them as soon as possible.

Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The Committee met on Wednesday, December 20th. Present:—Henry Cole, Esq., C.B., in the chair; Lord Gerald Fitzgerald; Sir John Harington, Bart.; Colonel Scott, R.E.; and Edgar A. Bowring, Esq., C.B.

Mr. HENRY F. CHORLEY was further examined by the committee:—

498. You have expressed a wish to make a few additions to the evidence you have already given before this committee?—I did so: but, on reconsidering the matter, find that I have one or two things only to add. On looking over the testimony offered by me on 12th June, though it was said at a moment's warning, and under natural restraint—the constitution of your committee considered—having looked over my evidence rather carefully, and having revised it for publication in the Society's *Journal*, I do not find one word I have to unsay, or one instance unjustly adduced, or one opinion that has not been strengthened by the experience which subsequent inquiries have brought to me. Let me add (as the only witness as yet examined who has been at no period connected directly or indirectly with the Academy) that I have taken some pains in the interim to ascertain what objections, if any, could be made against the facts I brought forward, and the opinions I delivered, on the part of those who think more favourably of the institution than myself.—Not one assertion in disproof has reached me; and hence, I repeat, my present testimony will, of necessity, be less both in quantity and importance (whatever that may have been) than my former one.—Meanwhile I consider that much which Mr. Macfarren has stated goes to confirm my conviction that the whole establishment is in such a thoroughly rotten state that there is no possible patching of it up.

499. Will you favour the committee with your opinion as to the station in the musical world which the principal of the Royal Academy of Music in this country should hold?—He should be some such man as Cherubini. Get the very best man that you can—no matter of what country.

500. And pay him well?—Pay him so well as to make it worth his while to make it his principal business. The reconstruction of a musical school, such as ought to have government support, will be no light task, neither will its superintendance.

501. Have you any notion of what you would consider a liberal payment?—That must, I suppose, in part depend upon the sum you get from Parliament.

502. What kind of grant should you like to see?—I have already stated that—and I find that the same sum has suggested itself to other bystanders besides myself.

503. You desire to have an annual grant from Parliament of £10,000. With such a grant as that what would you consider a proper salary to be paid to the principal of the Academy, of such standing as you indicate?—Assuming the income from the public funds at £10,000 a year, a fair remuneration to the principal would be, I should think, £1,500 a year.

504. Giving the whole of his time to the duties?—The larger part; you could not have a young or an inexperienced man.

505. Do you think it necessary that the whole of his time should be given to the duties?—Not necessarily; it is possible, while the students are in bed or away from the Academy, the Principal may, if he pleases and is able, compose. Both Cherubini and M. Auber have done so; but it should be his primary ambition to make the school successful, and he should not be interfered with save on very grave grounds.

506. You would have a claim upon the whole of his time?—Every man must have a portion of leisure, as I have explained and instanced already.

507. You consider he should keep himself up to the current mark, and not get in arrears in his own speciality?—I cannot give a stronger instance than Cherubini, who raised the Conservatoire of Paris to the highest point to which any musical school was ever raised.

508. If Parliament were disposed to make a liberal grant, you would not object to the Academy making annually a full report to Parliament of its proceedings?—Quite the reverse: the fullest information should be laid

before the country at stated periods; but I would have the administration of its affairs, as I have already said, and will repeat, in as few hands as possible, and made as despotic as possible, and as little interfered with as possible by the perpetual suggestions of *dilettanti* patrons.

509. You would think it necessary, however, in addition to the Parliamentary grant, if there should be contributions from the public in any shape, that the public should be represented in the management of the Academy?—Yes; with regard to certain scholarships. If a person choses to bequeath £100 as a legacy to establish a scholarship, why should he not do so?

510. That is hardly the point. If funds are derived from the public, do you not consider that the subscribers should have the privilege of electing one or more persons to represent their interests?—I doubt it very much—any more than I would have every one founding a scholarship permitted to nominate his own scholar. It might lead to perpetual bickering, partisanship, and jobbing. If the admission to the Academy and its privileges was made sufficiently stringent, if its discipline was wisely considered, and its concerns uprightly administered, I conceive that sufficient check would be provided to prevent any abuses, which would not, at once, present themselves in the report. Let me turn to another point. I do not wish to oppose the views of Mr. Macfarren, but I have very great misgivings regarding anything in the shape of concerts by the students, because everybody goes to them disposed to admire and to praise; the fathers and mothers of the pupils, and the people who have paid for their education. You can hardly get a good general judgment of the performances under such circumstances.

511. Do you not think concerts by former pupils might be established?—I don't see what earthly good they would produce. I think when a student has finished his education, he will go somewhere else, and you cannot rely upon the old students for the concerts.

512. Do you not think old students residing in London would attend the concerts once or twice in a year for the benefit of the Academy?—I doubt any measure of the kind. I don't see that you would get any good by it. It would always be like a bad charity concert.

513. Are not the concerts given by the Conservatoire of Paris performances of the former pupils?—The whole system is so different. If you give me the Conservatoire of Paris I will give you the concerts. Further, at the Conservatoire of Paris the performances are helped by the best possible talent out of the Academy that is attainable; otherwise they would be as lame in orchestral execution and in solo singing as I have frequently heard them in the choruses the students prepare. Nor is any student's music admitted save under the severest restrictions. They are a series of conservative entertainments, singularly barren of enterprise and variety of selection, which, however perfect in some points, owing to the narrowness of their range, which admits of the polishing process being carried to its utmost, I cannot think have any great bearing upon, or reflection of, the state of the French school for music and drama.

514. You would not have concerts of the Academy unless they could be of such a character as to attract large audiences?—The band of the Conservatoire of Paris is not composed of students alone, but they engage the best *artistes* that can be procured.

515. In addition to the orchestra of the Conservatoire?—Yes.

516. Do not all the pupils take part in the concerts?—They may, if they are wanted; but the band is made up of the greatest musicians they have.

517. But do not all the pupils play in the band?—I should be sorry if they did.

518. Do you happen to know if the pupils of the Conservatoire are allowed or obliged to take part in the concerts of that institution?—Surely; and then there is this thing that ought to be said about the Conservatoire of Paris—any pupil who obtains a first prize in singing, has a right to make his or her first appearance at one of the government theatres, and pupils distinguished for declamation have I believe a like privilege for appearing at the Théâtre Français.

519. Do you think that system worthy of imitation in this free country?—Yes, decidedly; so far as it can be carried out, but the matter would adjust itself. Any competent musician is sure of remunerative occupation in this country, and this with less waiting (and, I am glad to add, less intriguing for the suffrages of the press, or the aid of any indirect influence or unfair patronage) than, I fear, is the case in France, Germany, or Italy.

Mr. B. ST. JOHN B. JOULE (of Manchester), examined by the committee:—

520. Do you think the Royal Academy of Music in its present state has the confidence of the country at large?—As far as I know the feeling, it has not that confidence.

521. Important evidence has been given before the committee, showing that there is a disposition on the part of the authorities to make it conform itself to the times, and to enter upon a course of improvement. Supposing it were all you conceive a central institution should be, do you think, in its reformed state, it would have the confidence of the country?—Yes; I think among local professors and the musical public connected with country towns, the feeling is that it is out of the question to try to establish any local institution which could offer the advantages that could be afforded by an Academy in the metropolis—particularly on account of the variety of talent required in such an institution. Although we have Mr. Hallé at Manchester now, and though he employs many excellent orchestral players, yet his residence in Manchester may be only temporary. I think Manchester would be well satisfied with an efficient central institution somewhere.

522. And would directly or indirectly support it?—Yes.

523. Do you think such central institution should be in the metropolis?—I think that is the general feeling.

524. Do you think one such institution would suffice for the whole kingdom?—Yes; I think so.

525. As you take great interest in music, perhaps I may ask what may be your personal connection with it?—I was for seven years honorary organist and choir master at Holy Trinity Church, Manchester, and I have subsequently held the same position for upwards of twelve years at St. Peter's Church, where the best available talent is engaged, and full choral service is performed.

526. You have considerable knowledge of the musical feeling of that locality?—I am personally acquainted with most of the professors and amateurs of music, and I have for many years attended every principal concert in Manchester, and have written the critical notices of them which have appeared in the *Manchester Courier*.

527. You think it likely Manchester would be glad to send up young persons having musical ability to be educated at a central national institution?—I think it is likely, and I have heard an opinion to that effect expressed more than once.

528. Do you think the parliamentary representatives of Manchester would give their support to a liberal grant for the purpose of placing the musical education of this country on as good a footing as in other countries of Europe?—Perhaps they would; I should hope so. One principal deficiency in the Academy, as it now exists, is the absence of scholarships worth competing for, a want which a liberal grant would meet.

529. Are you aware that the State at the present time gives to students of art throughout the kingdom training as teachers an allowance of £1 per week for maintenance and gratuitous education, besides which their teaching costs from £40 to £50 a year each?—Yes.

530. You think an analogous proceeding might be taken with regard to music?—I decidedly think it would be a fair and proper thing.

531. You think the country at large would gain advantage by it?—I think so.

532. What is your opinion with regard to Mr. Macfarren's proposal to attach a chapel to the Royal Academy for the performance of choral services by the students?—I quite agree with all his views on that subject, and he has left me very little to add upon it, except to suggest that the institution should be careful not to lose control over the chapel by permitting it to be consecrated. I think a licensed chapel would be a great advantage, not only as giving the pupils opportunities of hearing our own church music of the highest class, but as preparing them as singers and organists for the duties which in very many cases, in fact in nearly all country towns, professors of music undertake in order to supplement their incomes. We generally find a professor of music in a country town looks forward to the position of organist as a means of introduction as well of direct income.

533. You do not sympathize with the difficulties which some people might apprehend in a religious or conscientious point of view?—I do not see any great difficulty in the matter. I think a professor coming from the Academy, after training in that particular class of music, would be received by the clergy with greater favour and confidence.

534. Do you consider a great improvement has of late years taken place in church music?—As far as the north of England is concerned I consider an immense improvement has taken place and is still progressing.

535. That is not to be received as an argument against going on farther.—I think it is a reason for going farther.

536. Do you think it desirable or advisable to institute collateral educational establishments in the large towns of England connected with the Royal Academy in London, or do you think pupils from different parts of the country should be sent to London to be educated?—I think they should be sent to London. I think it very likely the local teaching would be found not to agree with the practice of the professors in the academy, and that would be productive of disadvantages, not the least of which would be the consequent loss of time.

537. You would require that a student sent up from any locality should be certified as having musical aptitude?—Certified by a local board or professional testimonial; but I would not allow such certificate or testimonial to supersede an examination in London, because, in the case of local boards and private testimonials, an unbiassed judgment may not always be given, local and personal influence being sometimes very great.

538. There is a practice in the Science and Art Department as follows:—A student may present himself for examination at the central examinations conducted by the Science and Art Department, and if he passes that examination his expenses are paid by the department. If he does not pass he has to bear the expense himself. What do you think of such a plan?—I think that is a very fair arrangement, and I think a similar one would be equally so in the department of music.

539. Assuming the institution to be in the metropolis, you have no desire for any particular situation?—No.

540. You would not like Smithfield on account of its being most centrally situated?—I think the name would be sufficient, besides I doubt whether Smithfield can be considered the *musical* centre of the metropolis.

541. Do you attach importance to having a musical library?—I think it a necessary appendage of such an institution. It occurs to me to add to what has been stated by Mr. Macfarren on that subject—that though it might not be desirable to remove the contents of the British Museum to another locality, yet there are many works which are useful for reference—particularly in the study of harmony and composition—which, on account of their expense, most persons would scarcely like, and many might not be able, to purchase. Thanks to the enterprise of our publishers, many excellent works on the theory, &c., of music have been brought within the reach of ordinary students, but the full scores (the study of which is so important) of the vocal and instrumental compositions of the great masters, Bach, Handel, Gluck, Haydn, Mozart, Cherubini, &c., are still expensive, and will most probably continue to be so. These I consider it highly desirable that the Academy should have.

542. In the art training school there is an art library, and two copies of the more important works are obtained, one of which is circulated among the classes throughout the country when they desire it; do you think anything of the same kind would be useful in regard to music?—The circumstances are different. You are not proposing, as I understand, to have local musical institutions.

543. Are there not local philharmonic societies?—Not in Manchester.

544. They have in Liverpool?—Nothing which approximates to a musical school at all. The principal artists, I believe, as in Manchester, are engaged for the night; the members of the band for the season, but the latter are called upon for no further practice than the rehearsal which precedes any ordinary concert.

545. With respect to the fees at present paid by the students of the Academy—viz., thirty-three guineas per annum or eleven guineas per term, do you think it advisable to lower the scale of fees paid by the students, or do you think it would be unadvisable to admit them at too low a scale of fees?—I think increasing the scholarships would be preferable to lowering the scale of fees.

546. You think a good education is worth paying for?—Anything good is worth paying for. I think the difficulty might be met by increasing the number of scholarships, which would be most likely to benefit the persons receiving it. All the persons who go to the Academy to study ought, I think, to pay for it.

547. You would see no objection to a graduated system of this kind—that high musical ability should, if necessary for its development, be educated at the expense of the state; and that somewhat less ability should be educated at a low fee; and that so far as the accommodation of the premises permitted, the public should be educated at fees that may be remunerative to the institution?—I think that would be a very fair way of putting it. I think the general public should pay for this as in everything else. I think it would be a misappropriation of the funds to give education to persons who do not wish, or are not likely, to make a return for it. I think the ability or not to pay for the education has nothing to do with the matter. I think the question of payment should rest upon the musical ability of the pupil.

548. Do you think that this Academy should be devoted to a large number of pupils of moderate talent, or to a select number of great talent?—On that point I think a great deal depends upon the grant obtained from Parliament.

549. You think it would be more creditable to the country itself to educate its own pupils than that they should be attracted to foreign academies for that purpose?—Very much so; and I think it would not only advance the English School of Music but that it would be to the benefit of the pupils themselves in many respects that they should receive their education in England.

550. You think there would be no difficulty in finding enough pupils to educate if a thoroughly good Institution were established for that purpose?—I think not.

The Committee then adjourned.

CANTOR LECTURES.

THIRD LECTURE.—MONDAY, JANUARY 15.

ON COPYRIGHT AND TRADE MARKS. BY G. W. HASTINGS, ESQ., LL.D.

Mr. Hastings, in commencing his third lecture, said that, in dealing with the subjects selected for the two latter lectures of his course, it was not his intention to enter into legal technicalities so much as to bring under the notice of the audience certain leading principles, and to

discuss the policy of legislation. It was in this manner that the topics of "Copyright" and "Limited Liability" would be treated. Copyright is generally classed with patent right, and in legal treatises they are often discussed together. In a sense this is correct, both being incorporeal rights, and having certain points of resemblance; but in some respects they differ essentially. The policy of maintaining a patent system has been much debated of late years, and nowhere more eagerly than in this Society. That is a question not to be entered on in this lecture, but it may be well to point out that there are arguments in favour of the maintenance of copyright which would remain intact, even if the reasons advanced for the abolition of patents were adopted by the Legislature. Copyright, for instance, is in the specific thing produced, as a book; patent, of a process, or of the use of the thing invented. Copyright, therefore, does not, like patent, operate as a monopoly. When Sir Walter Scott wrote the novel of "Waverley," he invented, so to speak, the historical romance in this country. Now, if the Legislature had granted to him the sole and exclusive right for a term of years of producing historical novels, that would have been analogous to a patent; what he had was the privilege of printing and publishing the specific work of "Waverley," to the exclusion of others. No one was forbidden to compose historical novels; no one was forbidden to imitate "Waverley." It might be imitated closely, in the scenes described, the period chosen, the characters delineated; nay, if the mental process by which Scott worked could have been discovered, that might have been appropriated; it was only the book itself, the *ipsissima verba*, which could not be pirated. And observe the results which flow from this distinctive difference. Both these rights or privileges, whichever they are to be termed, are founded on the principle of public benefit. We hear a good deal occasionally of the rights of inventors and the rights of authors, but neither can have any rights but such as are consistent with the public good. The Legislature considers it is for the benefit of the state that mechanical invention should be encouraged, that new processes of manufacture should be discovered, and that a knowledge of such inventions and processes should be secured to the public, and it therefore says to the inventor, file your specification so that all men may know your discovery, and then we will give for a term of years a monopoly of the use of the invention. So it is considered of the highest importance that the creations of genius and the results of thought and labour should be permanently embodied in writings, and those writings printed and published for the enlightenment of the nation; the state, therefore, says to authors, Give to the world the produce of your mental toil, and for a certain term of years you or your representatives shall reap the exclusive profits. But whereas the patent privilege thus granted may, for a time, check production and defer the public benefit (as in the case of a manufacturer who retains for his sole use the superior process invented, and shuts out others from employing it), the copyright privilege has the opposite effect of ensuring the public benefit at once by encouraging the printing and sale of the work, that is, the gift of the knowledge embodied therein to mankind. Copyright, therefore, has nothing of the nature of monopoly, unless, indeed, it be in the matter of price, but that, as Professor Christian long ago observed (long indeed before his enlightened views were adopted even in reference to general trade), may be safely left to the natural law of supply and demand, the interests of the author and publisher being, as a rule, coincident with those of the public. Nor let us, before leaving this branch of the subject, forget to consider for one moment how great and substantial is the public benefit which the legislation on copyright aims to secure; the accumulated thought, the continuous experience, which literature embodies, is the mark between human kind and the beasts that perish; it is that which makes man a progressive animal. Everything that tends to increase the stock of thought and experience confers a gain—everything that tends to decrease it inflicts a loss on humanity. What do we not owe to a single generation of thinkers? What did not the world lose by a single event, when the Alexandrine library perished in the flames? Copyright has been spoken of as a privilege; and so it is; but it may be questioned whether the expression can be accurately applied to the existing law of this country. Is not the term of 42 years, which is now the allotted portion of authors, to be regarded rather as a restriction? Are the statements usually made on this subject either abstractedly just, or historically true? The ancient common law right was in perpetuity—a fact sufficiently proved by evidence too various to be gone into at length here. But the records of the Star Chamber in the reign of Charles the First, and the preamble to the Licensing Act in that of Charles the Second, show that the property of the author in his work was fully recognised, and that no term of years was assigned thereto. Doubtless the common law right was subject to this grave inconvenience, that it could only be enforced by an action for damages, and as those who pirated works were generally men of straw, the remedy was, in fact, nugatory. It was probably on this consideration that the statute of Anne, the foundation of the present law, was enacted; protection was thereby limited to 14 years (no doubt borrowed from the Patent Act); but it was made efficient by the summary penalties enforceable for piracy. It seems to be taken for granted at present that this statute wholly superseded the common law, and, of course, since "Donaldson v. Becket," it is undeniable that such is the law. But it is certain that the highest legal authorities long thought otherwise. The common law judges twice expressed an opinion that the old right was still in existence. Lord Chancellor Hardwicke granted an injunction to restrain a re-print of "Milton's Paradise Lost," at a time when the copyright had expired under the Act of Anne, and there are other indisputable authorities to the same effect. It was not till the year 1774 that the House of Lords finally crushed out the perpetual property of authors by their judgment in the case above mentioned, which was delivered after taking the opinions of the twelve judges, who were equally divided on the question. All trace of the perpetual right, however, is not yet lost, it being retained by the Crown and by certain Universities and Colleges. Would it be politic to restore it to authors? It is difficult to find any reason which would justify an answer in the negative. The price would always be regulated by the wants of the public, as is shown by the cheap editions daily issued of works in which the copyright is still existing, and the only other danger to the state—that of suppression of a valuable work from individual motives—is already provided against by a section of the 5 and 6 Vict., enabling the Judicial Committee of the Privy Council to authorise the independent publication of any book which the representatives of the author may attempt to suppress. But this question is not likely to come practically before the legislature—at any rate at the present time. The present statute, obtained after a hard fight, is regarded as an equitable compromise—the bargain struck between Parliament and literature being, that the protection to the author and his representatives shall be for a long term of years, and be readily enforcible on condition that the property finally revert to the public. The history of the legislative struggle which terminated in granting the present term of forty-two years as the minimum of copyright, is very instructive, and the rival principles that have been advocated as the basis of the law are nowhere so well expounded as in the pages of *Hansard*. The shabby little term of fourteen years, under the statute of Anne, was increased to twenty-eight years by the 54 Geo. III., and the existing Act (5 and 6 Vict., cap. 45), which repealed the previous enactments, has extended the protection to forty-two years after publication, or seven years after the author's death, whichever period may last ex-

pire. This great boon was obtained chiefly through the strenuous exertions of the late Mr. Justice Talfourd, when Sergeant Talfourd and a member of the House of Commons, whose own literary genius gave him a quick sympathy with the interests of authors, while his eloquence and thorough mastery of the subject ensured him the attention of the House. In the debate on February 5th, 1841, he was opposed by Mr. Macaulay, and the speeches of the two authors and orators, both marvellously lucid, are nearly exhaustive on the subject. There is a point which deserves notice in the existing law of copyright, on account of the monstrous results to which it has led. It has been laid down that copyright does not exist in any work of an immoral, seditious, or blasphemous tendency, and Lord Eldon, when on the woolsack, gave some remarkable applications to the doctrine. It was the habit of that Chancellor to refuse legal protection to any work which, having read or glanced at, he considered, on his own authority alone, to come under any of the above descriptions. He asked for no evidence, he took no opinion, but decided on his sole judgment, prejudice, or caprice, thus erecting himself into the most hateful of all despotisms—an irresponsible censorship of the press. For instance, the eminent living surgeon, Mr. Lawrence, was refused protection for his lectures at the College of Surgeons on the ground that they tended to deny the immortality of the soul, and to favour materialism. "The law," said the Chancellor, "does not give protection to those who contradict the Scriptures;" which, being rendered into English, meant, "As long as I sit here, no man shall be protected who differs from my own interpretation of the Bible." So an injunction was refused to Lord Byron for his wonderful poem of "Cain," in which the expressions put into the mouth of Satan had scandalized Lord Eldon. But the folly of these decisions equalled or surpassed their injustice. Southey, in his young days, wrote a poem called "Wat Tyler," which was outlawed by the Chancellor for its democratic opinions, and the immediate consequence was that copies of "Wat Tyler" were sold at a penny a-piece by thousands. It is an apt illustration of the fortunate truth that bigotry nearly always outwits itself. It may be said that no such decisions would be pronounced at the present day. Perhaps not; but they are unreversed, they are therefore law, and the power is a dangerous one to entrust to any individual. Save the Licensing Act of Charles the Second, the worst measure of the worst reign in our history, there is nothing so disgraceful to English jurisprudence.* The remarks by Lord Campbell, in his "Lives of the Chancellors," on this subject are well worth perusal. Mr. Hastings then observed that the introduction of International Copyright flowed naturally from the establishment of a law of copyright in all civilised countries. Literature is of no nation, and its interests are equally sacred to all. If it is just to protect the work of an English author, it must also be just to protect the work of a French, German, or American author. An Act has been passed during the present reign, having in view the carrying out of a system of international copyright, and it has to some extent been successful; but it is founded on a principle which he conceived to be radically wrong. The Queen was empowered, by Order in Council, to conclude conventions with foreign governments, and to extend to the authors of any foreign states the same privileges in this country as English authors enjoy in that state. In other words, the enactment is framed on the basis of driving a huckstering bargain in a matter which ought to be regulated by purely moral considerations. If it be only honesty and justice to give due protection to authors, whatever their country may be, England should do that duty irrespective of the conduct of others. If England would set an example in this matter all the civilised world would feel morally compelled to follow. France is, in this respect, ahead of us, and much as the repression of letters in that country is condemned, and justly so, it is certain that the Emperor has shown an enlightenment on the law of copyright which has not as yet been evinced by her Majesty's Government. It is also most desirable to consider whether a system of international registration should not be adopted, by which the lists of registered works might be transmitted reciprocally by the bureaus of different countries to each other, and registration in one country be thus made efficacious for protection in all. Having touched on the distinct subject of copyright of design, concerning which he thought the legislature should bear in mind the necessity of giving speedy remedies for any infraction of short terms of protection (having known a case in which the final judgment in favour of the inventor was given about six months after the copyright had expired), Mr. Hastings concluded by some observations on trade marks. It was a matter for congratulation that the Society of Arts had recently appointed a committee to investigate the subject, for it was one on which considerable and just dissatisfaction existed among the mercantile class. What is really wanting, and it lies at the bottom of the matter, is a system of registration. Any plan for international protection should be based on the broad and upright principle advocated with respect to copyright, that England should do justice herself without reference to the conduct of others. By the aid of those who understand the question in its political and legal aspects, a measure may be framed which will give adequate security to the productive industry of the country, and greatly diminish, if it cannot extirpate, the immorality so disgracefully prevalent which acknowledges and even boasts of frauds as dishonest as the theft of a purse from the pocket.

* Milton, in his immortal prose work, demolished the licensing system. It is a pity that "Paradise Lost" was not written in Lord Eldon's time, as it would, of course, have been denounced from the judgment seat, and a still more forcible sketch might have been drawn by its author of the bygone days of liberty, "when books were as freely admitted into the world as any other birth; when the issue of the brain was no more stifled than the issue of the womb; when no envious junto sat cross-legged over the nativity of any man's intellectual offspring."—*Areopagitica; or, a Speech for the Liberty of Unlicensed Printing.*

SEVENTH ORDINARY MEETING.

Wednesday, January 17th, 1866; Thomas Webster, Esq., Q.C., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Barnes, James Richardson, Brookside, Chirk, near Ruabon.
Beggs, Thomas, 37, Southampton-street, Strand, W.C.
Binyon, George, 106, York-road, Lambeth, S.
Buckley, R. W., Currig Bawn, Ballintemple, Cork.
Coales, Robert, 10, Trinity-square, Southwark, S.E.
Elias, Alfred, 18, Princes-gardens, W.
Forrest, G., Springfield-house, Muswell-hill, N.
Goadby, Edwin, Loughborough, Leicestershire.
Graves, Boydell, 6, Pall-mall, S.W.
Gray, Thomas, Board of Trade, Whitehall, S.W.
Hamilton, George, 106, York-road, Lambeth, S.
Joule, Benjamin St. John Baptist, Thorncliffe, Old Trafford, near Manchester.
Mackreth, George Edward, 18, Little Tower-street, E.C.
Newmarch, William, F.R.S., Messrs. Glyn, Mills & Co., 67, Lombard-street, E.C.
Rule, Rev. W. H., D.D., 45, Bedford-street, Plymouth.
Smedley, Joseph Valentine, M.A., Oxford and Cambridge Club, S.W
Stewart, George, 47, Mark-lane, E.C.
Taylor, Samuel, 13, Manor-place, Walworth, S.
Wright, William, 32, Bucklersbury, E.C.

The following candidates were balloted for, and duly elected members of the Society:—

Dalrymple, Robert Farre, 46, Parliament-street, S.W.
Edwards, Rev. Joseph, Vicarage, Barrow-upon-Trent, Derby.
Galpin, Thomas Dixon, La Belle Sauvage-yard, Ludgate-hill, E.C.
Garrod, J., 56, Upper Thames-street, E.C.
Gideon, Henry H., 8, London-street, Fenchurch-st., E.C.
Harton, Samuel, jun., 61 and 62, Shoe-lane, E.C.
Shaw, Matthew T., 64, Cannon-street, E.C.
Smith, William Baxter, 37, King-street, Cheapside, E.C.
Southey, Thomas, Clapham-park, S.
Walker, Robert, 58, London-wall, E.C.
Watson, Charles, M.D., 1, South-crescent, Bedford-square, W.C.
White, W. W., 5, Great Winchester-street, E.C.
Wieler, William Julius, 73, Mark-lane, E.C.
Williams, William, 41, Basinghall-street, E.C.
Wontner, Thomas, 26, Bucklersbury, E.C.

The Paper read was—

AUTOMATIC TELEGRAPHY.

By ALEXANDER BAIN.

INTRODUCTORY REMARKS.

Electricity is, unquestionably, the most extraordinary law or force of nature. It exhibits its presence everywhere, and in everything, by the effects it produces; we see the effects in the air, the sea, and in the more solid materials of the earth; and, although we cannot see the force itself, we weigh it as it were in a balance. We can produce its effects by simple friction or by change of temperature, by chemical action, or by the motion of magnetic bodies. We can produce artificial currents for short or long periods, perhaps for any duration of time; already they have been in constant and uniform action for upwards of twenty years, and have performed well the duty assigned to them.

It would, however, be unwise in us to imagine that all the effects of this most subtile force have been discovered; it is more probable that it silently produces in nature many effects which are not observable by our senses, or at least have not yet been discovered. But be that as it may, the effects which we have already become acquainted with have led to many important results, and are still leading onward to greater achievements; and of all the purposes to which this force have been applied the telegraph seems to be the most wonderful. It is now capable of conveying our thoughts hundreds of miles far faster than we can think them, and many times faster than we can write them. In doing this it will travel overland through conductors, and back again by similar paths, or it will travel out by the earth or sea and return through other conductors, or it will travel out by conductors and return by the earth or sea. It will print our thoughts on paper in common type, or it will merely exhibit them to the eye. It will write autograph letters hundreds of miles away, and it will draw our attention by audible sounds. It will tell mariners at our seaports the exact Greenwich time to less than a second by the falling of a ball, whereby they may regulate their chronometers without leaving their ships. By it we can regulate all the clocks in a town, or even work them throughout the whole kingdom, or find the longitude of places with far greater accuracy than could ever be done before. By it we can sound the deepest sea, and it will tell the mariner the instant the lead touches the bottom. It can work the machinery of our lighthouses and produce the light at the same time, besides many more purposes of utility too numerous to be described here.

Of all the effects produced by this force, magnetism has hitherto been the most extensively used for telegraphy. This seems to have arisen from the fact of its being more easily applied, and for some special purposes it is unquestionably the best; for instance, for the purpose of working the traffic of railways, where but few signals are necessary to be transmitted at one time, or between establishments at moderate distances, where but few messages are sent and but a few words in each, there can be nothing better used than electro-magnetic instruments, which can be in the form of letter-showing apparatus so that any one can work them without previous teaching.

But when we come to general telegraphs for public use, which are often hundreds of miles in length, and the messages very numerous and often very long, the case is far different, and is presented to us in a very different aspect. Here, for various important reasons, which will be presently explained, we find the chemical effects of electricity are far better for our purpose than the magnetic effects.

AUTOMATIC TELEGRAPHY.

Automatic telegraphy consists of methods of transmitting and receiving previously-composed messages between distant places by means of self-acting machinery in connection with electric circuits, and where properly carried out, it is distinguished from common telegraphy by the great celerity with which messages can be sent and received, as well as by the great accuracy it ensures in the transmission and reception of intelligence. Indeed, the advantages it offers has appeared to the writer of this paper so vast, that he has devoted to it much thought, time, and labour. He was induced to do so from the following reasons, viz., seeing that the action of the human hand, however expert, could never take a tithe of the advantage of the speed of electricity, and also that the use of numerous wires was very objectionable in consequence of the increased expense, but far more so from the great difficulty of obtaining good insulation among many wires of great lengths. At the time he first turned his attention to the subject of electric telegraphy several wires were used for each pair of instruments, and never less than three, in consequence of which he endeavoured to contrive methods for reducing the number of wires, and soon succeeded in producing instruments capable of working on a single circuit, and afterwards succeeded in working with a single wire, having discovered that the earth might be used with great advantage for one half of the telegraphic circuit. As this property of the earth is unquestionably a most extraordinary phenomenon, and still remains a paradox even to scientific men, and plays now a most important part in telegraphy throughout the world, and as the discovery has been independently made by others as well as the present writer, it will be well to give the ideas of scientific men respecting it, for instance, the writer on mathematical and physical science in the "Encyclopædia Britannica," eighth edition, vol. I., p. 986, observes, under the head of "The Earth Circuit,"—"There is one circumstance connected with the electric telegraph deserving of particular notice, I mean the apparently infinite conducting power of the earth when made to act as the vehicle of the return current. Setting all theory aside, it is an unquestionable fact that if a telegraphic communication be made, suppose from London to Brighton, by means of a wire going thither passing through a galvanometer, and then returning, the force of the current shown by the galvanometer at Brighton will be almost exactly doubled; if, instead of the return wire, we establish a good communication between the end of the conducting wire and the mass of the earth at Brighton, the whole resistance of the return wire is at once dispensed with. This fact was more than suspected by the ingenious M. Steinheil, in 1838, but, from some cause or other, it obtained little publicity; nor does the author appear to have exerted himself to remove the reasonable prejudice with which so singular a paradox was naturally received. A most ingenious artist, Mr. Bain, established for himself the

principle, and proclaimed its application somewhat later, and, in 1843, perhaps the first convincing experiments were made by M. Mateucci, at Pisa."

Again, Lardner observes that "of all the miracles of science surely this is the most marvellous. A stream of electric fluid has its source in the cellars of the Central Electric Telegraph Office, Lothbury, London; it flows under the streets of the great metropolis, and, passing on wires suspended over a zigzag series of railways, reaches Edinburgh, where it dips into the earth, and diffuses itself upon the buried plate. From that it takes flight through the crust of the earth and finds its own way back to the cellars at Lothbury."

Instead of burying plates of metal, it would be sufficient to connect the wires at each end with the gas or water-pipes, which, being conductors, would equally convey the fluid to the earth; and, in this case, every telegraphic despatch which flies to Edinburgh along the wires which border the railways, would fly back, rushing to the gas pipes which illuminate Edinburgh, from them through the crust of the earth to the gas-pipes which illuminate London, and from them home to the batteries in the cellars at Lothbury.

Although the automatic system has met with much opposition and neglect for a period of nearly twenty years, the writer thinks the time is fast approaching when the increasing requirements of the public will compel its general adoption; indeed, this necessity is partially shown by the number of telegraph inventors who have brought forward machines on the same principle during late years; but it is more clearly shown by the huge double ranges of numerous wires we already see stretched in all directions over the country, causing a vast (first) outlay, and a continual unnecessary expense to keep in order; but, setting the matter of cost aside, let us look at the working effect. It is well known that in damp and foggy weather, however well insulated the wires may be, small portions of the electric fluid will escape, from wire to wire, at all the points of suspension, and often from one to all on the same line of posts, especially between the longer and shorter wires, causing confusion among the instruments, and this confusion is greatly increased when many instruments are working at the same time.

Again, when storms arise, numerous wires, especially when near each other, present so large and compact a surface to the gale, that they are far more liable to be broken or blown down than one or two would have been, especially when snow or ice collects upon them. Should this take place to a considerable thickness, a heavy gale must exert an enormous force against them, so much so, that the posts or wires must give way (as has recently happened), very likely both. And when such a disaster takes place, what is the result? Why, it will take as many weeks as it would days were there only one or two wires to repair, causing an immense loss to the public, as well as to the companies themselves, leaving the great cost of repairs out of the question.

Yet notwithstanding these well known facts, these double ranges of many wires are stretched within a few inches of each other for hundreds of miles amidst the humid air of this country. Among numerous wires the fluid has thousands of chances of escaping from one to all, or any of the others. These chances are invariably seized, and hence deranged action of the instruments, causing mistakes, repetitions, general confusion, and consequent delay, and every additional wire put up only adds to the difficulty. In consequence of the foregoing reasons, the chief object of every telegraphic engineer should have been to contrive instruments of the greatest possible celerity, for the purpose of doing as much work as possible with a single wire. With a view to that end the writer turned his attention to the subject of automatic telegraphy at an early date, and in 1843 patented an automatic copying telegraph. Diagrams of these instruments are shown. They consist of two powerful pendulum clocks, and two smaller pieces of clockwork; these last are moved by weights, which consist of metal frames, in each of which is placed a plate, N, composed of conducting and non-conducting materials, in the following manner:—A frame is filled with short well insulated wires parallel to each other, and then filled in with sealing wax, so that the whole forms a perfectly compact body; the two flat surfaces are then ground perfectly smooth, and are permanently fixed in the metal frame, at the back of the plate, in which may be placed either a composed form of printers' types or any other surface which may be desired to be copied at a distant station, and chemically prepared paper at the receiving station. Each of the pendulums carries a metallic arm, the points of which act as tracers on the surface. Now let us suppose one frame filled with a previously composed form of printer's types, and the other frame with chemically prepared paper. The electric current will flow from the positive pole of the battery to the type, from thence through the small wire to the tracer, up the pendulum to the long telegraph wire, down the pendulum rod of the receiving instrument, through the tracer to the short wires, and from thence to the chemical paper, forming thereon a series of small dots, corresponding with the forms of the types at the transmitting station. The magnets to the left of the clock movements release the small clock-work so as to allow the frames to drop through a small space at every vibration of the pendulums; the pendulums regulate each other at each vibration to the left.

The writer believes that this was the first copying telegraph ever contrived, but as the plan required that all the instruments should go sinchronously together, or that several wires had to be used, either of which he soon saw would produce too many difficulties for practical use, it was proceeded with no further, and is only noticed here to show that the invention of that class of scientific toys, called copying telegraphs, is much older than many imagine.

Having by the foregoing efforts gained much experience, although he had arrived at little satisfactory results in automatic telegraphy, he decided to compose the messages in some simple telegraphic characters by mechanical means, and after much labour, and the trial of many methods, he was fortunate enough to hit upon the plan of composing the messages by means of punching groups of perforations in paper, in such manner that each group represented a letter, numeral, or other sign, which has turned out to be a most simple and efficient plan. At first the punches were operated by hand, without the aid of machinery, and the working was consequently rather slow, but the writer having subsequently contrived machinery for the purpose, they can be now worked with great rapidity.

Of all the known effects produced by electricity, the chemical has been found by the writer best suited for automatic telegraphy, principally because it is quicker in its action than any other, having nothing of ponderability to move, and consequently no inertia to overcome.

Electro-magnetism, it is true, would answer to some extent, but in that case ponderable bodies had to be moved with great rapidity by the electro-magnetic force, and on long telegraphic lines the force being small, all the mechanical actions produced by it must be of necessity very delicate, and require fine and delicate adjustments, which have to be often varied with the varying strength of the currents. Besides, delicate mechanical actions are always liable to get out of order; so that, after much thought, and numerous experiments with the magnetic as well as the chemical effects of electricity, the writer decided to use the latter only for his automatic system, as the currents would have nothing to perform but decomposition at the point of the chemical pen, the machinery being worked by other power.

In order to show how the chemical property of the current may be made to produce visible marks or signs, let us suppose a sheet of paper, wetted with an acidulated solution of ferro-prussiate of potash, and laid upon a

plate of metal, and let the point of a steel, or copper style, be applied to it so as to press it gently against the metallic plate. Let the style be now put in metallic connection with the wire which leads to the positive pole of a voltaic battery, and let the metallic plate upon which the paper is laid be put in connection with the wire which leads to the negative pole. The current will, therefore, flow from the style through the moistened paper to the metallic plate, and it will make a blue or brown spot thereon according as the style is of iron or copper.

If the paper be moved under the style while the current flows, a continuous line will be traced upon the paper. If while the paper is thus moved the current is permitted to flow only during intervals of long or short duration, the paper will be marked with lines long or short, according to the intervals during which the current flows; there being no mark made during the suspension of the current. The long or short lines thus traced upon the paper will be separated one from another by spaces more or less wide, according to the lengths of the intervals of suspension of the current. It is evident that the same effects will be produced, whether the style be at rest and the paper moved under it, or the paper be at rest and the style moved over it. The paper may be moved under the style by various mechanical expedients. It may be in the form of a ribbon coiled upon a roller, and drawn under the style, which was one of the writer's first plans, or it may be in the form of a common square sheet and wound upon a cylinder, to which could be given a revolving motion, and at the same time receive a slow motion in the direction of its axis, so that the course of the style upon it would be that of the thread of a screw or helix; this was also one of the plans the writer adopted in his early experiments, but the plan he has found most convenient in practice is to cut the paper into the form of circular discs, of about 18 or 20 inches diameter, and after being chemically prepared, any required number are laid upon a metallic disc of equal size. To this disc is given a motion of revolution round its centre, in its own plane, by clockwork, or any other convenient power, while the style receives a slow motion directed from the centre of the disc towards its edge. In this case the style traces a spiral curve upon the paper, winding round it continually, and at the same time retiring constantly but slowly from its centre towards its edge.

PUNCHING MACHINE.

Fig. 1 represents a plan of so much of the punching machine as will explain the principle of its action. A is a roll of ribbon paper; B and C are two revolving discs for the purpose of drawing forward the paper from off the reel; D represents the punch; E a finger key, with its axis at F; H is a pulley which receives rapid motion from a wheel driven by the foot, similar to that of a sewing machine; I is an eccentric on the shaft G, which gives rapid to-and-fro motion to the rod K, on the rod G; at L there is a screw which works into, and gives motion to, a wheel, M, which is on the shaft of the disc C. It will be observed that when the pulley H receives motion from the band, the eccentric I gives rapid to-and-fro motion to K, at the same time the screw at L gives a slower motion to the wheel M and the discs C and B, which draw forward the paper in front of punch D. Now, if the finger key is pressed down at E, (shown in elevation by Fig. 2.) the other end of the key will raise the rod opposite the punch, which will be pressed forward rapidly and punch the paper. If the key is pressed but for an instant a short hole will be punched, but if kept down for a longer interval a longer hole will be punched. In this way groups of short and long holes can be punched at pleasure representing letters, words, and sentences, and thus messages can be composed of any length and with considerable celerity. These messages can then be carefully compared with the manuscripts from which they were taken and, if needful, corrected before being placed in the transmitting machine, so that no mistake should ever be sent along the line.

FIG. 1.

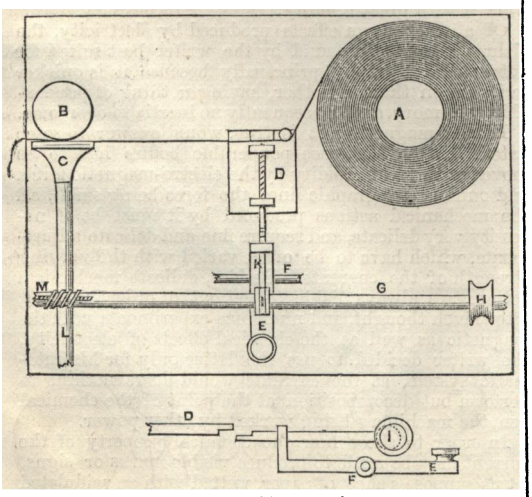
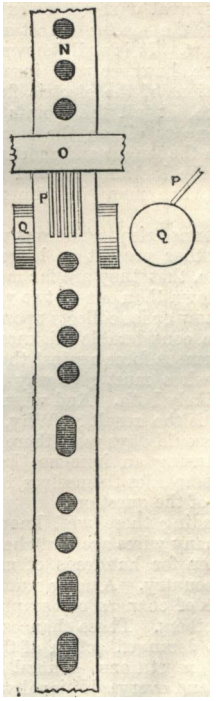


FIG 2 (*Elevation.*)

TRANSMITTING APPARATUS.

Fig. 3 is an enlarged view of so much of the transmitting apparatus as will explain the principle of its action. N is a portion of paper ribbon with groups of perforations, each group being supposed to represent a letter of the alphabet; O is a metal bar in which are fixed five metal springs in the form of the teeth of a comb; Q is a metal roller insulated from O, except at the points of the springs P. Now let O and Q be in the telegraph circuit, and the paper drawn through, as it may be, with great rapidity, when the perforated portions of

FIG. 3.



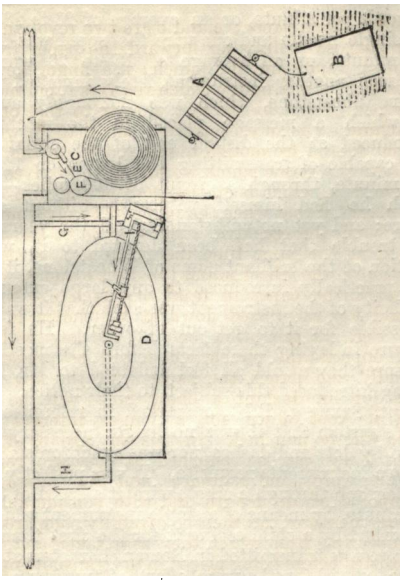


FIG. 6.

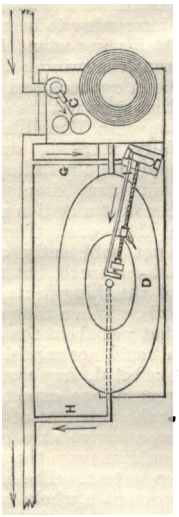


FIG. 5.

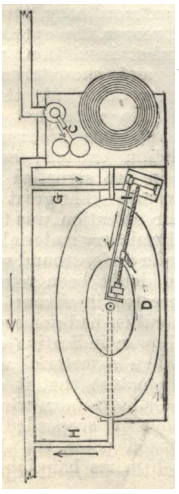


FIG. 4.

the paper pass under the springs they come into contact with the roller Q, and the current flows through the circuit, and when the unperforated portions of the paper are under the springs the current is interrupted thereby. In this way electric currents can be sent through telegraph circuits with extraordinary rapidity and perfect accuracy in their duration and grouping.

RECEIVING APPARATUS.

The receiving portion of the apparatus is a revolving disc carrying chemically-prepared paper, and a metal frame carrying a revolving screwed shaft; on the upper end of this shaft is fixed a roller, which lies gently on the disc. The screwed shaft carries a style-holder. As the disc revolves it gives motion of rotation to the roller, and consequently to the screwed shaft, which causes the style-holder to recede slowly but constantly from the centre towards the outer edge of the disc. Now let us suppose the apparatus properly arranged in the telegraph circuit, as is well known, the currents from the comb and roller at Fig. 3 will pass through the style into the chemically-prepared paper at the receiving station, and make marks thereon corresponding exactly in their lengths and their grouping with the perforations in the paper shown at Fig. 3.

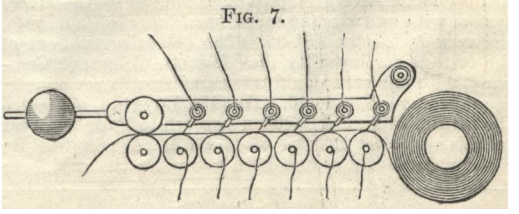
Having thus described the principal actions of the composing machines, and also of the transmitting and receiving apparatus, let us now proceed to show how they are combined so as to form a complete system.

The author proposes to have only two wires at most on one line of posts, one to be called the up wire, and the other the down wire, so that messages can be transmitted in both directions at the same time. The messages are transmitted by the apparatus through the main wire in the manner shown at Fig. 3, but his experience has shown him that the best way to receive the messages is through branch circuits, so as to keep the main wire contacts always complete, except in the process of transmission. Figs. 4, 5, 6, represent three different stations on a telegraph line. A represents a galvanic battery, C the transmitting apparatus, and D the receiving portions at each of the stations; the transmitting and receiving apparatus, it will be observed, are moved by the clock mechanism at C, the instrument (Fig. 6) is shown in the act of transmitting. Figs. 4 and 5 are shown in the position of receiving. Although only three instruments are shown, there may be any desired number on the same line.

The action is as follows:—The current passes from the battery A to the main wire, from thence to the spring E, through the perforations of the paper to the roller F, then to the frame of the clock-work, and from thence to the main wire, but at each of the intermediate stations, when they are necessary, a portion will pass down through the ends of the branch circuits at G, to the frames I, through the styles to the chemical paper, and will return by the end H to the main wire. In this way the currents are made to write a copy at every station on the line, but at the stations where copies may not be desired, all that the operator has to do is to lift up the pen from the paper, and let it stand in the position shown at Fig. 6, or he may turn back the penholder frame altogether away from the disc.

Fig. 7 shows a method by which a despatch can be transmitted from a central station, say from London, to

FIG. 7.



any number of telegraph lines simultaneously, so that the despatch may be received and written at any number of towns on each line, in the way already described.

This system has been proved electrically, chemically, and mechanically in England, France, and America. It can transmit intelligence from London to the farthest corner of England or Scotland at the rate of, in round numbers, six words per second, 333 per minute, 20,000 per hour, and with a degree of accuracy never before obtained by any other system, and, further, it can automatically transmit despatches of any length from any place, say from London to all the principal towns of England simultaneously at the above-named degree of celerity.

DISCUSSION.

Mr. OWEN ROWLAND said he fully expected this evening that Mr. Alex. Bain would have had with him some instrument to afford the meeting practical proof that he had mastered the great difficulties of automatic telegraphy. There was no doubt that within the last week the electric telegraph had made its usefulness felt more than it ever had done from the earliest date of its introduction; for its failure, owing to the destruction of the wires by the snow, had been most severely felt by all classes throughout the country, and showed the necessity of guarding as far as possible against such an accident for the future. Looking to the generally recognised importance of the system, he thought that an extensive failure like that which had just occurred should, as in the case of railway accidents, be a subject of close inquiry. There was no doubt the present state of electric telegraphy was not so satisfactory as it ought to be. The improved instruments which had been invented by such ingenious men as Wheatstone, Bain, Morse, and Hughes, though their merits were recognised in other countries, had been but little introduced here; but the time would come when shareholders in these great companies would insist upon knowing why this was the case. He feared it was, in some instances at least, owing to the officers of companies being commercially interested in inventions of their own. As proprietor and one of the editors of the only public journal devoted to the science of electricity, a vast number of communications reached him from all parts, the burden of which too frequently was the quarrels between patentees, and he felt thankful that he was not himself a patentee. In the year 1863, he was appointed by the Earl of Shrewsbury referee, in conjunction with the Mayors of Liverpool and Manchester, to test the relative merits of Professors Hughes and Bonelli's systems. On the latter plan, five series were used, and were capable of transmitting 20,000 words per hour, or about 330 per minute. One young lady was able to "set up" twenty to twenty-five words in about 85 seconds, so that the telegraph could keep fifteen compositors at work. The action of that telegraph was very beautiful, but the great drawback was, that it required five wires to work it. Mr. Bain claimed to be able to do the same amount of work with one wire, which brought his system nearer to that of Professor Hughes,* which also consisted of one wire, the messages being delivered in ordinary Roman type. One hundred to one hundred and twenty-three revolutions of the wheel per minute at five words per revolution would give 615 letters per minute, or an average of 45 words per minute. This system, though greatly opposed in this country, had been extensively adopted in France. By the Morse system with one wire the speed was 30 words per minute, the average being about 25. The bell telegraph, one of the systems employed by the Magnetic Telegraph Company, with one wire would transmit 50 words per minute, or an average of 30 to 40. He (Mr. Rowland) witnessed the transmission of the Queen's speech to Paris last year by this system at the rate of 40 words per minute. By the double needle system with two wires the speed was 35 words per minute, or an average of 23 to 28. With the single needle and one wire the speed was 25 words per minute, or an average of 15 to 20 words. He had seen another instrument, lately invented by Professor Wheatstone, which was thoroughly automatic, by which a message placed in the machine was reproduced at the distant end of the circuit. This was capable of transmitting 600 letters or 120 words per minute, through a circuit of 400 miles—a result which he had himself witnessed—without a single failure; and yet notwithstanding all the years of toil and trouble that had been devoted to it, with the addition of the brilliant name of Wheatstone, it had not been practically introduced to any large extent. The simplicity of the instrument was such that it was almost impossible for it to get out of order. He felt great pleasure in laying these facts before the meeting, and was sure they would all feel indebted to Mr. Bain for having introduced this subject to their notice.

Capt. SELWYN, R.N., remarked in reference to Mr. Bain's system that it was no longer necessary to telegraph by dots and dashes, nor was synchronism between the two instruments requisite. It was perfectly possible to telegraph through a single wire at a speed of 36 words per minute, by means of a single instrument which could be worked by a child seeing it for the first time. The message was transmitted in Roman characters at the rate he had stated by the mere effort of turning a handle, and that system was in operation on some portions of the French railways. It was very interesting to hear of such excessive rates of speed, but it was important to know whether that speed included the transcribing the message (which might be said to be in cypher), and sending it out of the office, because if that were not the case, no fair comparison could be made with Bonelli's system. They were told that to fully work a single instrument at that speed would require fifteen telegraph clerks, which was, in fact, impracticable. They could not have fifteen clerks at a station all night long—they rarely had more than one. These were points which inventors did not sufficiently consider. They put forth a very magnificent speed, but they did not regard the practicability of the thing in its application to ordinary every-day work. When they obtained thirty-six words per minute, that was about the quickest writing that a skilled penman could accomplish, and if that rate of transmission were effected, they would have done quite as much as the present age expected. He was, however, not one to limit the progress of science, and he believed they would soon arrive at a complete codification of words which would increase the rapidity of transmission to an enormous extent. The letters A, B, C, for instance, might represent a whole sentence, and he thought that was a more practical way of obtaining speed than any extraordinary rapidity of working the instruments. Moreover, the speeds spoken of that evening implied perfect insulation, while it was known that the fogs and snowstorms materially interfered with the working at the speed contemplated by inventors. He need not say, before such an audience as he was addressing, no such thing as perfect insulation existed; and as a general rule the instruments in use signalled quite as rapidly as the wires could transmit. The great question which forced itself upon their attention was the utter insufficiency of the principal insulatory materials at present employed, more especially for underground wires, the improvement in which had no doubt been retarded by the interest which had been created in favour of high-priced gums, and sufficient attention had not been given to materials of less cost and lower indicative capacity. He expected to see the time when a material would be found so indestructible in its nature that it could be employed for the insulation of subterranean wires so as to obviate the present system of suspended wires; and when one saw the distorted poles, the displaced tiles, and the loose telegraph wires hanging in such

* See *Journal*, vol. VII., p. 334.

admired disorder over the houses and streets at the present time, they must come to the conclusion that suspended wires were a mistake. The necessities of the case had no doubt given rise to the present system. The pole telegraphs were constructed in the first place with one or two wires suspended on poles of sufficient strength to support them; but as business increased, it was necessary to add more wires upon the same poles, which were strengthened as far as possible to carry the additional weight, and under these circumstances it was not to be wondered at that when an unusual stress came upon them they failed. The desirability of resorting entirely to subterranean lines of telegraph seemed manifest. The reason they had not been adopted to a greater extent was owing to the rapid destructibility of the insulating materials employed. As he had before observed, they had not sought for other substances for that purpose than those which had been presented to them, but he might state that he had lately tested the material known as paraffin with the best results. He should not venture to speak on this subject from his own experiments alone; but he had been assisted in them by some of the best electricians of the day, including Professor Miller, of King's College. It was a most indestructible material, and was superior in lowness of inductive capacity to any insulating material that had hitherto been produced. If they could give to the telegrapher the material he required as an insulator, it would be neither to the interest of the shareholders or the public to persist in the use of antiquated materials or antiquated processes in telegraphy.

Mr. OWEN ROWLAND inquired of Capt. Selwyn whether he he had tested paraffin, especially under varieties of temperature, say from 60 degs. to 72 degs.

Capt. SELWYN replied that paraffin itself, of course, melted at a low temperature, but mixed with india-rubber in certain proportions, which was the form in which he had tried it, it did not yield to a lower temperature than gutta-percha. Moreover, when that mixture was vulcanised by the cold process, it resisted a temperature of 600 degs. without the least damage.

The CHAIRMAN in proposing a vote of thanks to Mr. Bain for his communication, remarked, that this subject had not been brought before him as an entire novelty, but as an invention many years old, then imperfect in its details, and now greatly improved. That was the main object of the author's paper. Mr. Rowland and Capt. Selwyn had adverted to the various interests which operated to prevent the introduction of great improvements in electric telegraphy; but it was to be borne in mind that there were also strong interests at work to promote them. When a science like this had advanced to a certain stage, and where large sums of money had been expended upon the existing means and processes of telegraphy, those who were in possession of these systems were generally the last persons to introduce any radical improvements. They were satisfied with things as they were so long as they realised a fair return for their money; they were essentially conservative in their principles; and they liked to let well alone. The introduction of such a system as that of Mr. Bain and other inventors would involve the sacrifice of a large portion of the capital already embarked in the present undertakings. That so great an improvement in the speed of transmission of messages would ultimately make its way there could be no doubt, and he conceived that the bringing the subject before a Society like this, whereby the community were made acquainted with the most recent advances made, was the best means of forcing them upon public attention. He was somewhat surprised that no gentleman had risen in defence of the existing systems and in opposition to the suggestions which Mr. Bain had laid before them. He was struck with the observation of Capt. Selwyn, that one of the matters to which they ought to give special attention was the different gums and materials adapted for insulating purposes, for the experience of the last few days would satisfy them that the sooner they gave up the system of poles and wires the better. It had been known for years that they might have a perfect system of electric communication by wires under ground, but that was a question of an expense very much greater than the pole system. Besides, it had been found that neither gutta-percha nor its compounds, nor india-rubber nor its compounds, could be absolutely relied on for the purposes of subterranean telegraphy. Therefore, it was not only the question of expense which deterred companies from adopting the underground system, but the extreme uncertainty of the insulating materials. It was well-known that gutta-percha was subject to various influences which deteriorated its properties, and, to that extent, companies might be justified in not adopting it, even if it had been of less expense than the pole system. The occasional inconveniences of that system were, however, notorious, aad the inconveniences to which the last week had subjected the community, would probably lead to the reconstruction of the whole system, and if Capt. Selwyn and others, who had the opportunities of experimenting upon guns and other insulatory materials, would communicate the results, they would confer an important benefit upon the public at large, as nothing was more wanted than a substance that could be thoroughly depended upon as an insulator. Assuming a good material and good means of communication to be provided, the next question was with regard to the instruments to be employed for the transmission of the messages; and upon that subject he sympathised with the observations of Mr. Rowland, as to the squabbles which existed among patentees and inventors. He had a high opinion of Mr. Bain's automatic system; and from that gentleman's long absence from this country he might probably not have been aware of the advances which had been made in Wheatstone's and other systems, but still it was to be remembered that Mr. Bain was one of the first to bring this system forward, and the public were indebted to him as one of the pioneers in this great work. Mr. Bain had laid before them, in a very clear and able manner, the general principles of his automatic telegraph, and for having done so he was sure the meeting would tender that gentleman their best thanks.

The vote of thanks was then passed and acknowledged.

The following extracts will be read with interest as showing the results obtained by Mr. Bain's system, particularly in America :—

"*Communication on the Electric Telegraph.*—The President of the Society for the Encouragement of National Industry, Paris (Session May 8th, 1850), announced that Mr. Bain had arranged in the hall his ingenious system of electric telegraphing, of which M. Sequier had during a previous session given a description, which greatly interested the members of the Society.

"The Abbé Moigno was invited to give an explanation of this apparatus, to which invitation he quickly responded.

"In this consists the ingenious mechanism of this apparatus, to which the author has given the name of electro-chemical telegraph, to distinguish it from the electro-magnetic telegraphs now in use.

"The message wished to be transmitted is written on a piece of long narrow paper by cutting, with the aid of a punch, the letters of a very simple alphabet composed of points and horizontal lines. This band is rolled on a wooden cylinder, and then unrolls itself with the aid of a crank, so as to pass on a second metallic cylinder, which supports four little springs which communicate with the conducting wire of the line; the metallic cylinder is connected with the pole of a battery of small volume and very simple construction.

"The band of paper presents in turn a covered part and a vacant space; this last represents the letters of the alphabet, whilst the covered are of paper—that is to say, an insulating substance. When the small springs

rest on the paper, the circuit is not formed, and the current does not pass, but as soon as the springs touch an empty place they are in contact with the cylinder, from that time the communication is established, the current circulating and arriving instantaneously at the station.

"There a small style is attached to the conducting wire of the line; below this style turns a metallic plate, which is covered with a disc of paper, chemically prepared by dipping it first in a solution of sulphuric acid and afterwards in a solution of prussiate of potash. The plate, and the disc with which it is covered, communicate with one of the poles of the battery at the station of arrival. The current is afterwards completed through the earth.

"The despatch is transmitted in the following manner:—At a given signal the style is applied to the chemical paper at every empty space on the band of paper, which is unrolled by the crank, the current passes, and, under its influence, the point of the style, by the chemical action which it exercises, traces a point or a little line of a very dark colour, which is the representation of the letter which must be reproduced at a distance.

"The band on which an entire page is written unrolls itself with extreme rapidity, the plates, drawn by a clock-work movement, turn also with great quickness. After 45 seconds the 1,200 letters composing this page appear very neatly drawn on the discs of the chemical paper, and were thus faithfully reproduced, and would have gone two or three hundred leagues further without any difficulty. The movement printed on the plate is a spiral one, so that successive lines do not interfere with each other, but remain entirely distinct.

"These are the advantages which the author attributes to his system:—1st, more accuracy and simplicity in the primitive construction. 2nd, More rapidity in the transmission of the despatches by a single wire with a good insulation."—*Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, 8th May, 1850, p. 236.

Extracts from *Lardner's Museum of Science*, on Bain's Chemical Telegraph:—

"The following experiment was prepared and performed at the suggestion and under the direction of M. Leverrier and myself:—Two wires extending from the room in which we operated to Lille, were united at the latter place, so as to form one continuous wire extending to Lille and back, making a total distance of 336 miles. This, however, not being deemed sufficient for the purpose, several coils of wire wrapped with silk were obtained, measuring in their total length 746 miles, and were joined to the extremity of the wire returning from Lille, thus making one continuous wire measuring 1,082 miles. A message consisting of 282 words was then transmitted from one end of the wire. A pen attached to the other end immediately began to write the message on a sheet of paper moved under it by a simple mechanism, and the entire message was written in full in the presence of the committee, each word being spelt completely and without abridgment, in fifty-two seconds, being at the average rate of five words and four-tenths per second."

A report of the directors of the New York Bain Lines states that messages are transmitted by them, without being re-written, from New York to Buffalo, a distance of 500 miles. This is done without any intermediate relay batteries or magnets.

Extract from a work entitled "History, Theory, and Practice of the Electric Telegraph." By George B. Prescott, Superintendent of Telegraph Lines, Boston, U.S., America:—

"*Bain's Electro-Chemical Telegraph.*—The next system of telegraphy, in order of its invention and introduction in this country, is the chemical, invented by Alexander Bain, of Edinburgh.

"Mr. Bain obtained a patent for his system in England in 1846, and applied for one in this country in 1849, but was refused upon the ground of infringement upon the Morse patent. It seems to have been the opinion of the commissioner that Mr. Morse held the exclusive right to electricity in any form in which it could be used for telegraph purposes, and that he was placed at the head of the Patent department solely to maintain it for him. Supposing this decision final, Mr. Bain left Washington to return to England, but was met in New York by Mr. Henry O'Reilly, who induced him to appeal to the Supreme Court. He did so, and the decision of the Commissioner was over-ruled, and Judge Cranch ordered a patent to be issued to him.

"Immediately on the granting of this patent, a number of public-spirited and enterprising merchants of New York and Boston set themselves to work to build an opposition line between New York and Boston, to be worked upon this system. The monopoly which had existed since the telegraph lines had been first established was so unpopular, that the construction of this line was hailed as a public blessing.

"The line was completed in the autumn of 1849, and the tariff between the two cities reduced from fifty cents to thirty cents per ten words. The line worked admirably—better than any had previously worked in this country, and business increased so fast that it was necessary to put up another wire at once. In the meantime lines working upon this system were constructed between New York and Buffalo, between New York and Washington, New Orleans, Louisville, and Cincinnati, between Boston and Montreal, and between Boston and Portland.

"From this date a new era seemed to open in the telegraph world; business increased rapidly; tariffs were reduced; lines improved in reliability; and public confidence began to be secured for the first time.

"Early in the winter of 1849, the proprietors of the Morse patent commenced suits, for the infringement of their patent, against the New York and Boston and New York and Washington (Bain lines). These suits were kept in court for nearly three years, when it was clearly evident if they were pressed for decision upon the merits of the case, the Morse patents would be destroyed, and the system thrown open to the world. This result was, of course, not to be desired by either party, and they therefore agreed to consolidate their lines, and use but one patent.

"The lines thus consolidated between New York and Boston were called the Union lines. They now use the Morse system, as they do upon all the other consolidated lines.

"There is at present but one Bain line in operation in this country, the one from Boston to Montreal. The Bain system, if not the simplest, is one of the simplest forms of telegraphy ever worked.

"No magnetism is used, and only the chemical effects of the electric current are necessary. A metallic disc, carried at a regular uniform speed by clock-work, receives a sheet of prepared paper. Upon the paper rests a screw plate, which serves to guide a pen in regular spiral lines from the inner to the outer surface of the disc, the circuit is what is known as the open circuit—that is, the key which throws the current from the battery on the line is always open when a message is being received from a distant station, and the current passes through the chemically prepared paper to the earth without uniting with the home battery, the negative pole of which is invariably connected with the earth, and the positive pole, by the depression of the key, with the line.

"This system has some advantages over every other which has been used in this country, not the least among which is its ability to work through a heavy thunder-storm, which none of the other systems can do without considerable danger, both to the operators and instruments.

"Another considerable advantage which it possesses is its ability to work over a greater escape than any other. We have known the line between Boston and

New York to do business during a heavy rain storm, with the wire actually lying on the ground. This system is capable of working a greater distance without the aid of relays than any other, and of working with a smaller battery.

"We have worked well between Boston and New York with but 10 cups of the Grove battery, all told, and have worked well between Boston and Buffalo, *viâ* New York City, without the intervention of repeaters or auxiliary batteries."

Mr. Joseph Whitworth, as one of the British Commission sent to the New York Exhibition of 1854, presented a report to Parliament, which has been published, and which supplies some interesting particulars. According to Mr. Whitworth, the most distant points connected by electric telegraph in North America are Quebec and New Orleans, which are 3,000 miles apart. and the network of lines extends to the west as far as Missouri, about 500 towns and villages being provided with stations. There are two separate lines connecting New York with New Orleans, one running along the sea-board, the other by way of the Mississippi, each about 2,000 miles long. Messages have been transmitted from New York to New Orleans, and answers received, in the space of three hours, though they had necessarily to be written several times in the course of transmission. When the contemplated lines connecting California with the Atlantic, and Newfoundland with the main continent, are completed, San Francisco will be in communication with St. John's, Newfoundland, which is distant from Galway but five days' passage. It is, therefore, estimated that intelligence may be conveyed from the Pacific to Europe, and *vice versa*, in about six days.

The cost of erecting telegraph lines varies according to the localities, but the expenses upon the whole are estimated to average about 180 dols. (£36) per mile throughout the States. The moderate amount of this estimate is, in a great measure, to be attributed to the facilities afforded by the general telegraph laws for the formation of companies and the construction of lines.

The electric telegraph is used by all classes of society as an ordinary method of transmitting intelligence. Government despatches, and messages involving the life or death of any persons are entitled to precedence; next come important press communications; but the latter, if not of extraordinary interest, await their regular turn.

The leading newspapers of New York contribute jointly towards the expenses of daily telegraphic communication. The annual sum paid by the "Associated Press" averages 30,000 dollars per annum. The following is the tariff for the press despatches:—

Under 200 miles,	1	cent	per	word.	
Between 200 and 500	„	2	„	„	
„ 500 „ 700	„	3	„	„	
„ 700 „ 1,000	„	4	„	„	
„ 1,000 „ 1,500	„	5	„	„	
„ 1,500 „ over	„	6	„	„	

Assuming three cents as the average, the total amount of matter received by telegraph for the New York Associated Press amounts to a million words per annum, or about 600 columns of a London newspaper of the largest size, averaging almost two columns per day. Supposing six papers to be associated together, the share of each would annually amount to about 5,000 dollars, or £1,000, for two columns of telegraphic intelligence daily.

Commercial men use the electric telegraph in their transactions to a very great extent. In 1852, there were transmitted by one of the three telegraph lines that connect New York and Boston between 500 and 600 messages daily. The sums paid on this line by some of the principal commercial houses who used it, averaged in 1852 for each from 60 dols. (£12) to 80 dols. (£16) per month. On other lines the leading commercial houses were estimated to pay from 500 to 1,000 dollars (£100 to £200) per annum for telegraphic despatches.

Interruptions occur most frequently from the interference of atmospheric electricity; in summer they are estimated to take place on an average twice a week, but many contrivances have been adopted for obviating this inconvenience, such as lightning arrestors, &c., which are generally known, the number of interruptions having been thereby reduced about 30 per cent. Other accidental causes of interruption occur irregularly from the falling of the poles, the breaking of the wires by falling trees, and, particularly in winter, from the accumulated weight of snow or ice.

The electric current is made to act through long distances by using local and branch circuits and relay magnets in those systems where it would be otherwise too weak to operate effectually. In Mr. Bain's system a weak current is found sufficient for very long distances; between New York and Boston, a distance of 270 miles, no branch or local circuit is required. In some cases where both Morse's and Bain's telegraphs are used by an amalgamated company in the same office, it is found convenient, in certain conditions of the atmosphere, to remove the wires from Morse's instruments and connect them with Bain's, on which it is practicable to operate when communication by Morse's system is interrupted.

Extract from the *Encyclopædia Britannica*, p. 179:—

"Another excellent invention of Mr. Bain's. A plan for transmitting apparatus is included in the patent (1846) in which he first specifies his electro-chemical recorder. It is described and commented on in the following terms by Highton:—

"'Another plan consisted in cutting out slits of different lengths in a long strip of paper at the transmitting station and allowing this perforated strip to pass uniformly over a metal cylinder with a pin or spring pressing on the top of the paper. Whenever, therefore, a hole in the paper passed under the pin the pin came into metallic contact with the cylinder underneath, and allowed a current of electricity to pass through the line-wire. All the holes in the paper and their length were therefore proportionately represented at the distant station by chemical marks of corresponding lengths on the prepared paper at that station. This form of telegraph is the quickest at present invented. It does not, however, seem suited to ordinary communications, but only to the transmission of *very long* documents on extraordinary occasions.'

"If one person only is employed to punch holes in the paper, it is evident that, instead of making a hole in the paper, a current of electricity might as readily be sent, and a chemical mark made at the distant station, and thus the message might actually be sent in the same time as that required for cutting the paper. But this remark applies only to the case where there is but one attendant for a wire. If a number of men be employed at each station, then, by dividing the message into parts, and each man punching out his part, the whole paper can be perforated in less time than one man could send the message. On uniting this perforated paper, and applying it to a machine, and on turning the cylinder round, corresponding chemical marks may be made at a distant station with very great rapidity.

"Mr. Highton proceeds to remark, 'The commercial question is, therefore, where ordinary communications are alone required, one of large working expenses *versus* a rather large outlay of capital in the first instance.' With this we cannot agree. It appears clear that the working expenses in carrying out Bain's plans, if the mechanical and electrical success were complete, must be less than would be required to do the same amount of work by hand through several wires, since only the same number of men will be required (the punching instrument being, it is presumed, workable at the same rate as a hand-transmitting key), and the expense of maintaining the extra wires and battery power would be saved. The fact that this plan has not come into universal use on all

lines where there is more work to be done than can be got through one wire by one hand, does not find its correct explanation in Mr. Highton's remarks. It seems more probable that some mechanical or electric imperfections, which may be remediable, have hitherto operated against the complete success of this admirable invention; and we are disposed to conclude that perseverance in attempts to improve its details would be rewarded by the achievement of a vast extension of the work done through the electric telegraph by land."

THE CATTLE PLAGUE IN THE LAST CENTURY.

The following is a reprint of the article* on this subject referred to in the chairman's address at the opening of this session :—

(Continued from Page 127.)

Bleeding has been practised by most who have attempted to cure the murrain. Many have done it promiscuously, in every period of the disease, others have confined it to the first stage only. Whoever considers the effects of bleeding on the habit and the nature of the distemper, as deduced from the symptoms, cannot doubt but that this evacuation must have largely contributed to augment the extraordinary number of those beasts which have died when subjected to medicinal treatment compared to that of those which have been left to the favour of nature. The failure of that degree of animal strength in some beasts which is found in others is, as we evidently see from the facts above-mentioned, not only the cause why one part of the cattle takes the infection while another escapes it, but also, why it proves mortal to one part of those seized with it while the other recovers. Now, it must be allowed that bleeding, when to such degree as to have any effect, more than almost any other means, diminishes the animal strength, or the force of circulation. Must it not then, in proportion, conduce to bring the strong cattle to that state of weakness which is the cause, as we have seen above, why the disease prevails over nature in some more than others, and to render still more weak those which were so?

It is not to be wondered at, nevertheless, that physicians who have hastily considered the murrain as an inflammatory disease† should adopt this most effectual means of resisting inflammation, but there is not the least ground for this notion of the nature of the disease.

In the first stage the contrary of general inflammation appears, for then the symptoms exhibit signs of languor and a disposition to insensibility. Nor is there any general inflammation seen in the whole course of the disease, except when deposits of the morbid matter are made in the last stage, which, if they prove eruptions or tumours in the external parts, are a salutary crisis that should not, on any account, be disturbed or checked, or, if they fall on the internal parts, are a fatal symptom not to be resisted, and are then, moreover, attended with such a state of weakness in the beast that any considerable evacuation must soon be followed with a mortal sinking. At what time, therefore, is the bleeding to be practised with a view to the relieving against the inflammation? In the first stage, when there is a total absence of any such inflammation and the whole danger of mischief lies in that of the want of sufficient strength, or in the last stage, when there is such a state of weakness that the evacuation must necessarily kill the beast; or such a critical eruption as, if suffered to take its course, may save the animal, but if checked or thrown in by the diminution of the fever, which supports it, must attack the internal parts and either cause instant suffocation or convulsions, or, in a short time, a mortification of those parts?* In every light, this evacuation appears to be injurious in the murrain. For, if there can be a case supposed where it might tend to relieve against a particular symptom, which is only when some internal part is inflamed by the deposit of the matter, yet such case would be desperate, and the evacuation would, in other respects, promote those effects that lead to fatal consequences. Bleeding for prevention of the infection, though not enumerated in the preceding view of the means used for that end, has yet been recommended by some physicians, and frequently practised. But, on the same principle, of exposing the beasts to the force of the disease by weakening them, it is of the same bad tendency as when used for the cure. Indeed, it does not in this case so generally do harm. For when it happens not to be performed nearly at the time of the beast's taking the infection, the cattle, except those which are naturally weak, recover their strength again, and the evacuation has, therefore, no consequence with regard to the distemper.

Purging has been frequently tried as a remedy against the murrain, in all the periods of the disease. There is

* The paper is entitled "Observations on the Murrain or Pestilential Disease of Neat Cattle: the Means of Preventing the Infection, and the Medicinal Treatment of the Beasts when seized with it," and is by Mr. Robert Dossie. It is extracted from his "Memoirs of Agriculture," Vol. ii., 1771.—ED. *J.S.A.*

† The notion that the murrain is an inflammatory disease has arisen from the hasty conclusion of physicians of its being similar and having a great affinity to the small-pox and plague. But it will be manifest, from moderate observations on the respective symptoms of them, that there is no such similarity or affinity betwixt them in nature. The small-pox always produces general inflammation and consequently signs of a strong fever in a greater or less degree in the first stage, and the excess of that inflammation is frequently the cause of its proving mortal. The same is seen in the plague, which begins with symptoms of strong fever and inflammation. Whence they may both be properly deemed inflammatory disorders, as inflammation is one principal secondary cause of the dangerous symptoms and mortality attending them. But in the murrain no such inflammation ever appears in the first stage, but the very contrary, nor does any great degree of heat occur till either towards the middle of the second stage, and then only in the case of a disposition to eruptions, when, as Dr. Layard has justly remarked, it is a prognostic of a recovery, or at the end of the second stage, when deposits of the morbid matter are made on the viscera and soon induce a mortification. In the small-pox an eruption is the sole salutary crisis which nature has instituted, and through which the subject can be saved. It is therefore, together with the preceding and attending inflammation and fever, essential to the disease. But, on the contrary, in the murrain, though eruptions are one mode of the crisis of the disease, or, in other words, one way by which nature discharges the morbid matter when of due maturity, yet they are often wholly wanting, even when the beasts recover, and, therefore, not essential to the disease, even where it has its full natural progress. For in the United Provinces, and other moist and low countries, eruptions are most frequently not found in the beasts which do well, but a diarrhœa, or looseness, constitutes the critical discharge, and, in such case, no great degree of heat arises in the whole course of the disease. This proves an entire diversity in the nature of the diseases to be betwixt the small-pox and the murrain, and evinces that the indications of cure which are adopted from a supposed analogy of them stand on a very erroneous foundation.

* Dr. Layard, who, on the whole, has written the most sensibly on this disease, says, "Bleeding, therefore, will be found necessary only when the inflammation is so considerable and the fever so high that nature is obstructed and cannot expel the morbid matter, and, whenever such symptoms are apprehended, prudence will require bleeding to prevent this coming on, according to the constitution, strength, or age of the beast." But I must dissent from the doctor as to his opinion that there are any cases which admit of a rule to be laid down for bleeding the cattle in the murrain. That *inflammation* does ever *obstruct nature so that she cannot expel the morbid matter* is a mere hypothesis, and, perhaps, might easily be shown to be such as it is not consistent with the known principles of physiology; I shall, however, waive any discussion of that kind here. It is sufficient to deny that any such inflammation is found in the course of this disease, as no

evidently the same objection to it as has made above to bleeding, since it undoubtedly conduces to weaken and exhaust the beast, and, consequently, to render nature less able to resist the force of the contagion. It is also from other reasons improper in this disease by whichever of the two courses, a diarrhœa or eruptions, nature seeks to produce a critical discharge of the morbid matter. Where there is a tendency to eruptions, as for the most part is found in England, this evacuation would necessarily make a derivation and endanger the stopping its progress; and, indeed, not only with us but in Italy, according to Lancisi, "A looseness is an unfavourable symptom and denotes the weakness of the subject." In Holland it is frequent and the cattle do recover with it. But where there is a disposition to it, or it is already begun, medicines which promote the same evacuation are certainly not proper, as they either bring it on before the due time or increase it, if already come on, to a degree that is beyond what the strength of the beast can bear. This, though not, perhaps, in every instance, must yet be the case in the greatest part. The most judicious observers agree, moreover, in condemning the use of purges in this disease, from an actual experience of their bad effects, and the adopting it has been certainly one source of the ill success which has resulted in the attempts made to cure the murrain.

Blisters have been also tried in this disease, but not in so extensive a manner as to afford the means of determining how far they may be of any avail in it. By the apparent tendency to a paralytic state, which is shown in the first period of the murrain, there is room to conclude that such a stimulus might come within the intention of cure. But whether it would be adequate to the indications or trivial in its effects can only be known from a large basis of observations. At all adventures, the difficulty attending the application of blisters to the diseased cattle by such persons as must have the treatment of them in general, renders their use a very unfit means of relief in the murrain.

Rowels, setons, pegging, and caustics have been in their turn vainly employed in the murrain. It must be admitted nevertheless that nature sometimes throws the morbid matter on a part already diseased by a wound so made, and in that case renders it the means of a critical discharge, as we see happen in other contagions. But this will rarely be the case, and where it may there is always a sufficient degree of strength to produce an eruption, which would answer the same end. In any other circumstances the discharge from these drains can be of no service towards the cure of the murrain. For they must know very little of physiology and the history of diseases who imagine a purulent discharge can be of any consequence in them, unless at the due period it be converted into a critical one by a deposit of the morbid matter on the part. In all other views this kind of evacuation rather impedes than promotes the cure of the murrain, as it tends to weaken and exhaust the subject, and consequently to promote the prevalence of the contagion over nature.

Mundification, performed by extraordinary cleansings and rubbing the skin of the beasts, has had great stress laid upon it by some who have undertaken the cure of the murrain. But it is admitted by Professor Camper and others, who have seen it much practised, to be of no avail. Indeed, the effects must be too minute to have any material consequence in a disease of so violent a nature, and if such laborious and constant cleansings, rubbings, &c., as are recommended were serviceable, the performing them would be impracticable where there are a great number of cattle infected without more trouble or expense than the chance of benefit from them would countervail.

The inefficiency of the above-enumerated various supposed remedies for the murrain are less to be regretted, because a great part of them would be attended with such expense and trouble as would render the general use inexpedient. And indeed the same may be said of all of them according to the manner they have been prescribed by those who have recommended them, in which several always, and for the most part many of them, have been combined together. Whatever method of cure is proposed to be actually serviceable in this disease it must be practicable with a moderate share of expense and trouble, or it will never be put in practice by the proprietors of cattle so generally as to save a sufficient number of them to be of any moment to the public. Very little regard has nevertheless been had to this consideration by the physicians who have taken in hand the discovering means of relief against the murrain. They seem only to have sought after what might be efficacious in nature, and directed the use of what they thought so without calculating in the least whether the consequence of its use could be lucratively of any benefit to the private persons who might adopt it, or reflecting, that if it were of no benefit to them they would not adopt it, nor the public therefore reap any advantage from it. Even the most able of those who have been engaged in this pursuit have seemed to forget wholly this circumstance which is indispensably requisite to the forming an effectual plan for the saving any material number of the cattle, as it would be more profitable to abandon them to

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strong signs of any appear but the shivering and heat in the earlier part of the second stage, which denote an eruption, and are, as above-mentioned, enumerated by the doctor himself among the prognostics of recovery, or the violent fever, which follows the attack of the disease on the viscera in the very last period, and is, consequently, always a fatal symptom. But admitting there were cases when it might be beneficial to bleed the beasts in this distemper, with a view to prevent the coming on of too much inflammation, or the consequences of it when subsisting, how are they to be certainly distinguished in practice? Few physicians would agree with each other in settling precise diagnostic marks of this indication. How then are untaught owners of cattle, on whom the task of judging on this matter must depend in the general execution of it, to determine on a point of so complex and nice a nature? On what, according to Doctor Layard's intimation, is to be grounded *the apprehension of the symptoms when prudence will require bleeding to prevent this coming on?* Some answer to that difficulty is, indeed, given in another passage of his essay below, page 65, where he declares, "If a beast be full-grown and fleshy, if a cow big with calf and of such colour as denotes strong fibres, then take away two quarts of blood from the neck. From a strong yearling calf, one quart; and so on in proportion to age and strength, but neither weakly nor poor thin cows, especially white ones, are to bled so much, if at all." But in the third chapter, where he treats of the prognostics, he enumerates these circumstances among the marks by which it may be discerned what beasts are least in danger of being attacked by the contagion and suffering violently from it, all which marks are, in fact, the appearance of strength, though he has not directly said so. Now, if strength be the preservative from the contagion and its effects, what is the consequence of bleeding those which bear such marks but, in fact, reducing them to the same state with the others which want this strength, or, in other words, rendering them equally unable to resist the effects of the contagion? Is not this setting up of art founded on vague principles for the sake of accommodating practice to the notions and hypotheses of darling writers, in opposition to the clear dictates of reason suggested by observation on facts. In chapter the eighth, speaking of the means to prevent infection, he is led round again to truth by the force of such observation. For there he very justly acknowledges the real fact that "Bleeding and purging the cattle, so far from being of use, has not prevented the disease, but rather the symptoms have been more violent in some who were bled and purged." The reason is obvious; because, being weakened, the beasts were less able to resist the contagion. But has the bleeding less effect in weakening the subject when performed after the infection has taken place than it had before? Surely it has not. This was delivered candidly from observation on the real phenomena. What we have before quoted was the result of theoretic reasonings founded on presumed principles, and the supposed authority of Sydenham, &c., in points where in reality no just analogy subsisted. Professor Camper wholly disapproves of bleeding in this disease from an extensive observation of its effects.

the effects of the disease than to incur a greater expense in attempting it than is balanced by the value of the chance of saving them.*

The knowledge of these symptoms, which are easily discernable and best distinguish the murrain from other disorders incident to cattle, and of the peculiar appearances that are produced in the inward parts of beasts which die of it, make by far the most important object of the communication of what regards this disease. It is extremely requisite that all owners of cattle should have a moderate acquaintance with these matters, in order they may as soon, and as certainly as possible, be able to inform themselves whenever their cattle appear to be out or order or die in a suspicious manner, whether they be infected with this disease or not. Without such means of judging they may either inadvertently suffer the contagion to spread in their own herds or to those of others, if it happens to be introduced to any of their beasts, or otherwise be led, from a mistake of other distempers for it, to be at great expense and trouble in trying to prevent it when there is no real occasion. It is of equal consequence, both with respect to the public and to themselves, that a certain degree of intelligence of the criterions by which the murrain may be known from other disorders should be possessed by magistrates, constables, parish-officers, and inspectors of cattle, particularly those near sea-ports, that they may, in some measure, be enabled to put the Acts of Parliament and orders of council concerning the disease into execution, as those acts lay a task upon them, should the occasion of their being inforced present itself, of a very nice and complex as well as momentous nature. I shall, therefore, first give an enumeration of those symptoms of cattle diseased with the murrain, and a description of those appearances it causes in the inward parts of the bodies of beasts that die of it, which are so simple and strong that they may be readily perceived and distinguished by any persons however little versed in the observation of diseases or other subjects of medicinal concern. I shall afterwards, for the use of others who may choose to carry their speculations further and attempt the study or cure of the disease, point out those more latent and less perceptible symptoms and effects of it, which require a previous knowledge of physiology to their being properly observed, and which are rather useful for investigating the nature and kind of the disease, and the best method of curative treatment of it, than for distinguishing it, by sensible marks, from other disorders of cattle. I shall proceed also to apply the whole to that purpose of examination, and to explain whatever can be at present collected of the physiological principles of the disease, in order to ascertain thence the best means of prevention of the contagion, and the proper intention of cure to be adopted in the medicinal treatment of such as are already infected.

The first apparent symptoms of the murrain are—a dry cough; a shivering and gnashing of the teeth coming on at considerable distances of time; shaking the ears and hanging down of the head as if from weakness; stretching out of the neck as when there is a difficulty of swallowing; moving often slowly from place to place seemingly in a constant state of uneasiness; decrease of appetite; diminution or, on the fourth day, total loss of milk in cows which are in a milch state, attended with a lankness of the belly and udder;* and sometimes costiveness. During the time these symptoms only appear the cattle will eat, chew the cud, and at some times look brisk and lively; but after the third or fourth days the following symptoms come on gradually but quickly, except in those beasts which have the disease in a very mild and gentle manner:—A constant heaviness and stupidity; a general weakness; a great decline of the appetite and chewing the cud; a frequent trembling of the whole skin, or of particular parts of it, especially about the flank and buttocks; a purging in some, or a discharge from the nose and ears; and a total loss of the milk in milch cows, if it has not come on before.

Where the disease is not slight, the above-specified symptoms are soon succeeded by these others:—A refusal of all food, and ceasing entirely to chew the cud; an increase of purging; the excrement becoming of a very yellow or of a dark green colour, stinking, and, in some cases, coming away of itself from the fundament, which seems continually open and moving; a difficulty and shortness of breathing accompanied with groaning and an extraordinary distention and widening of the nostrils; a scabbiness of the nose and lips; a great swelling of the belly; a restlessness, uneasiness on lying down, and defect of power, through weakness, to stand, whence the legs are extended outwards, as it were, to prop the body; eruptions on various parts of the body, but particularly about the flank and udder; miscarriage in pregnant cows; and, where the beasts are strong, hard tumours, like boils, especially along the back on each side the bone felt under the *panniculus carnosus*, or outward skin, which frequently break and discharge matter very fetid or stinking.

* In calculating the advantage that is to be received from any remedy for the murrain, the expense incurred by the use of it for the number of beasts actually saved must not be considered alone, but that of all those with which it has been used, in order to the saving such number, must be included likewise. In order, therefore, to determine the value of the chance of saving the cattle by any means of remedy comparatively with the cost of such means, it is proper to state the circumstances in this manner:—It appears that at present in Holland somewhat less than half the beasts which take the infection recover without the aid of any medicinal assistance, and in our country where, as we have before observed, the beasts are stronger, we may safely reckon at least that proportion. But as it is impracticable, when the signs of the distemper first appear, to distinguish with any certainty those beasts which would die without aid, it is necessary all those that are seized with the disease should be subjected to the curative treatment. Let us further, in order to bring the whole matter into this point of view, suppose a method proposed that would save one-half of the beasts which would die without the aid of it. It will then result from these premises that, on the whole, to save one beast the expense of the medicinal treatment must be incurred on four, as one-half would recover if they were left to nature, and only one-half of the other is to be saved by the medicinal aid. For a method which could effect that must be justly deemed highly efficacious. In the methods which have been recommended, and particularly that by the latest and best writer on this subject in our own country, the expenses of labour, medicaments, and extraordinary diet would amount in the treatment of each beast to at least one pound five shillings, and, according to some prescriptions, they would rise to double that sum; so that in any of these methods, according to the manner of computing here laid down, the saving each beast would cost at least five pounds, and in some of them ten. This great expense would not only take away all inducements in the view of gain from the owners of the beasts to employ such means for saving them, but the greatest part of such owners would not be able to make the disbursements necessary to it in proportion to their stock of cattle. As the whole must be provided and laid out in a short space of time, and it would therefore be more to their interest to submit to the present loss and recruit their stock by future resources.

* Doctor de Monchy, city physician to Rotterdam, in his "Remarks on the Mortality among the Horned Cattle," mentions a decrease of milk and a lankness of the belly in milch cows, and a drowsiness and cough in young beasts, as sufficient signs to discover this disease in the cattle. But though they may be good reasons for suspicion of it in places where the contagion is already in the neighbourhood, yet they are by no means alone just grounds to determine that cattle so affected are seized with the murrain when there is no likelihood of the infection having been conveyed to them. The decrease or even loss of milk in cows, and the consequential lankness of the belly, are attendant on any considerable feverish disorder, and the drowsiness and cough in young beasts may arise from colds or other epidemic disorders. I have mentioned this because Doctor de Monchy's dissertation has lately been translated into English, and such a passage in it may mislead and occasion false alarms respecting the introduction of the contagion into our country.

These symptoms go on, most of them augmenting, till the turn or crisis of the disease. They then begin to decrease, and some degree of appetite and chewing the cud to return, if the beasts recover. If otherwise, the purging becomes greater, or, if there were none before, begins with violence, and the dung passes off involuntarily, not only the anus but the tail seeming to lose all power of action. The eruptions, if there be any, flatten; or the tumours, like boils, under the skin grow soft; and the strength seeming to be spent, the beast dies suddenly without any other previous signs; or, in some cases is violently convulsed, roars loudly, throws out a large quantity of foam or froth from the mouth, struggles hard, and tosses about the head with great force.

The second stage of the disease is seldom continued longer here than three or four days, reckoning it, as above-mentioned, from the fourth day after the first signs of the infection. So that the general period of the distemper, from the first attack which was perceived to the crisis or turn, according to the course of the distemper as it subsisted here, may be accounted about seven or eight days.*

The time of appearance of the first signs after the infection is received is five or six days, rarely more, unless where the slightness of the disease renders the symptoms so gentle that they do not become perceptible till in an advanced period of it, but this cannot carry it beyond the ninth or tenth day.

It is not to be understood, nevertheless, that in every beast which has the murrain, all the above enumerated appearances will be found. For as different parts are affected in different subjects, the symptoms vary accordingly, particularly in the last stage; and the natural or casual habit of the beast, as to strength, age, and pregnancy, makes likewise a considerable alteration, both as to the kind, and the degree of the effects of the contagion. The symptoms of the first stage, except the costiveness, constantly attend, however, in a greater or less degree; and the greatest part of those of the second stage follow in a more or less violent manner. The discharge from the nose and eyes is very general; and scarcely ever wanting in those beasts which recover. The purging and swelling of the belly are also very frequent; and almost always occur in those beasts which die. The eruptions, and hard swellings like boils, are likewise very common here† in those which recover.

On the whole, therefore, by a due observation of the manner in which beasts seem affected, when several are seized with an unknown disease at nearly the same time and place, it may be determined, on very good grounds, when the contagion has been introduced. The hanging down of the head, and stretching out of the neck, with other signs of weakness, coming on in the first stage; and followed by the insensibility, tremblings, eruptions in the flank and udder, or hard swellings like boils along the back, and breaking out or scabbiness about the nose and lips, in the second stage; may be looked upon as peculiar symptoms which characterise the disease, and leave little room to doubt of its presence where they appear.

In order, nevertheless, to obtain a more positive certainty in any case where there is reason to apprehend, from beasts having died in the manner and with the symptoms above described, that the infection has been brought to any place, it may be further proper to examine the carcases of such beasts by opening them; and if it be as supposed the following appearances, or most of them, will present themselves. This examination must, however, be confined to such as die from the natural course of the distemper; and not extended to such as are killed, or have been subjected to medicinal treatment; because the disease has not then had its due and full effect on the parts; and the state in which they will then be must proportionably fail to answer the description above given.

A very stinking air, and sometimes matter, rushes out on piercing the skin, or making an opening into the cavity of the belly; particularly if there be swellings on the back, and the skin be pricked or cut in that part. The mouth, throat, and gullet are red; and full of small specks, or ulcers, attended with the appearance of what is called the thrush in children. The lungs are red, ulcerated, speckled with blackish spots, and sometimes fraught with small bladders of fluid like water. The liver is swollen, full of dark yellow gall, and rotten, so as scarcely to bear the touch; and the gall-bladder is stretched to a large size by greenish gall. The cud-bag, or paunch, is red, and discoloured with blackish spots, puffed up with air to a very great magnitude, and void of any fluid, but containing a hard mass of cud, which has remained there and is become dry, instead of passing to the other intestines to be digested. The honey-comb, manifold, and curd-bag are in much the same state with the cud-bag, except as to the various degrees of hardness and dryness of the cud in the two first, and that the curd-bag is empty. The smaller guts are spotted with red and black; and the end of the rectum or last gut, for some space above the anus or fundament, is black, rotten, and foul with clotted blood on its surface. The womb is red and enlarged in cows that are not pregnant, but in those with calf it is blackish. The fat, where any can be found, is of a high yellow colour and soft consistence. Collections or gatherings of matter are frequently met with in the cavities of the horns and head. When the greatest part of these appearances present themselves in the respective parts on opening the beasts which have died after the principal of the above symptoms have been observed in them, there can be no room to doubt but that they have had the murrain. Even where any accurate information may be wanting of the nature of their illness there is a very strong ground of conclusion that it was this disease, if, on the examination of the carcases soon after the beasts are dead, the eruptions, particularly the hard boils along the back, the scabbiness on the nose and barbs, the puffing up of the skin or belly with stinking air, the gathering of matter in the horns and head, the dry mass in the cud-bag, the blackness of the womb, and the rottenness of the gut next the fundament, or most of them, are found.

The symptoms and effects of the murrain, which may be deemed, less properly than the foregoing, the subject of the examination of persons not conversant in medicinal subjects, and less apparently the characteristic marks of the disease, but which may yet afford material lights for discovering the true nature and the indications of cure of it, are those which follow.

* In Holland the period of the murrain from the first sensible marks of it to the crisis or turn, is much longer than it appeared to be with us, and is most generally found to be about twelve days. The reason of the variation of the disease in this point betwixt Holland and here lies in the superior strength of our cattle, which enables nature in them to bring the disease to a crisis in so much less time. This greater degree of strength in our cattle manifests itself, as we have remarked elsewhere, in their more frequently throwing out eruptions in this disorder here than in Holland, and in their not being susceptible of the infection, except after very bad seasons, though less injurious epidemic causes render them so in that country.

† Though eruptions were very frequent in the murrain while it prevailed here, yet they are much less common, as has been above intimated, in Holland, and other low and damp countries, where the cattle are habitually weaker. When they do appear there, they are also different, for the most part, from those found in our cattle. For instead of being on the back, and large like other boils, they are generally about the flank and udder; and are less, flatter, and softer. The general crisis of the disease, in such case, is not by eruption, but by diarrhœa or looseness, which was found here, on the contrary, to be mostly a bad symptom. This is not, however, constant. For there are instances of beasts which do well in Holland without a diarrhœa; and there were some here of those which recovered with it. But the crisis, nevertheless, is here by far the most frequently an eruption, either on the back or about the nose and lips; and in those countries a diarrhœa.

In the first stage, heat, but not great, in the head, and particularly at the roots of the horns, attended with a coolness of the body and the extremities; hot and stinking breath; deafness; pulse quicker than in health, the strokes being from sixty to seventy, but irregular, though without stated remissions.

In the second stage, signs of sickness*; breath more hot and stinking; fetid steams from the skin; respiration difficult, particularly expiration laboured and performed with groaning; urine high coloured and turbid, but generally without any deposit of sediment, or any bad smell, and retained longer than in health, though not in the whole much different in quantity; dung acrimonious or sharp to such a degree as to leave a visible irritation for some time after in the anus; blood florid; seeming exacerbations of pain in the evening; a constant disposition to lie, but attended with such uneasiness in some that they stand almost continually, though with great difficulty on account of their weakness; an absence of thirst throughout the whole disorder, though with a willingness to drink in moderation; pulse increasing in quickness, according to the progress of the disease, from seventy to ninety, and having periodical diurnal remissions as in the paroxysms of fevers, but irregular, intermitting, and growing smaller as the velocity becomes greater.

On opening the carcases of beasts dead of the murrain these appearances will occur, together with those before enumerated:—In the brain the blood-vessels are found turgid and very red, and clots of grumous blood, as well as a lymphous fluid, show themselves frequently in the substance. On the membranes of the cavities of the nose, and the whole extent of the frontal finus, the large glands, and the medullary substance of the horns, marks of inflammation and excoriation will be seen. The kidnies and bladder are inflamed and void of urine. The flesh in some beasts is livid, in others of a lively red for a short time after the death of the beasts, but soon changing to a green colour. Appearances are found of emphysema, or vesicles of air, in the lungs, mesentery and cutaneous membranes in various parts of the body.

From the whole of the symptoms and appearances of the murrain we may draw these conclusions as to the nature and effects of the disease:—It is communicated from one beast to another by a contagious matter or virus that, acting as a leven, produces a ferment in the humours of the parts into which it is introduced, and either reduces the nerves of such parts to a paralytic or inactive state, or renders them too irritable and active, at the same time counteracting those natural ferments in such humours which are requisite for the due support of the animal economy. But when, from the strength of the solids giving due motion to the fluids, the natural ferments, are duly powerful, it cannot prevail over them, and therefore has no morbid effect. As we see in those beasts which escape the infection though exposed to the contagion. In those subjects where there is a default of such strength it goes on by the above specified means to weaken the force of the circulation and deprave the secretions, whence also that putrescence or putrid ferment to which all animal substances have a natural tendency, when not superseded by the vital ferments, is at length brought on, and if no critical expulsion be made in due time of the contagious leven by the fever induced by its effects, destroys the vital economy, and necessarily causes the death of the beast. But if, by the inflammation produced, the force of circulation and consequently the power of the vital ferment be so increased as to overcome that of the contagious leven, the morbid matter in which it resides is expelled either in eruptions on the surface or by a discharge from the intestines.

The progress and the manner of the action of the contagious virus in the murrain may, from the symptoms and the appearances in the dead beasts, be deduced to be as follows:—The first effects of the contagion appear principally in the head and the upper parts. It produces a certain degree of nervous weakness or paralytic disorder in those parts, as is shown by the deafness, dulness of the eyes, debility of the neck, and shaking of the head. This disorder affects also gradually the glands which secrete the saliva and lymph of the stomach, as there is found, in a more advanced stage of this disease, a total want of those fluids, the cud forming a dry concreted mass. At the same time, nevertheless, the glands of the nose and eyes are rendered more irritable, and the humours are secreted in them much more copiously than the natural degree. The paralytic disorder of the salival glands, and the glands of the stomachs, extends itself frequently in the first stage to those of the small guts, as may be inferred from the costiveness observed at that time. But this often changes afterwards into a great irritability in the second stage, as is evinced by the profuse diarrhœa attending. On the other hand the irritability of the glands of the nose and eyes seems to be continued to the membranes of the lungs by the cough, which is almost a constant symptom. The stomachs seem also to partake of the paralysis of the upper parts, and this appears to be in proportion to their nearer situation to those parts, as may be inferred from the retention of the cud in the cud-bag and honeycomb, and the emptiness of the cud-bag. There is an early effort of nature to make an expulsion of the morbid matter by the external parts of the head, as may be collected from the signs of topical inflammation which show themselves, and particularly about the horns, where abcesses are afterwards frequently formed. But this alone rarely proves a critical discharge.

After the first four days the contagion diffuses its effects much more generally, and frequently attacks the liver and the lower intestines, which then become very irritable; a great discharge of bile, and the other humours secreted in them, ensuing. But the inactive or paralytic state of the salival glands and those of the stomach yet goes on increasing, till all secretion by them ceases. Hence the appetite and digestion are entirely lost; and the inanition, caused by the want of a due supply of chyle to the blood, conspires greatly, with the nervous debility above specified, to bring on a great languor of the circulation and other vital action. This necessarily induces a putrescence of the juices; whence new sensible effects are produced, which may be deemed secondary symptoms; being not the immediate consequences of the action of the contagion, but the effects of the putrid ferment suffered to prevail by the suppression of the animal ferments, which counteracted it while they subsisted in the due degree. In this difference of the cause of the symptoms principally consists the difference of the first and second stages of the disease; the first exhibiting those alone which result from the action of the contagion on particular parts, and may,

* Doctor Layard has mentioned, along with the sickness, the throwing up of bile as one of the symptoms of the murrain. He does not intimate that he has seen it himself, but refers for it, in a note, to Aretæus "De Morbis Acutis." The notion of such a fact was a most palpable error in the first broacher of it, whoever he were; and it is a great inadvertence in the Doctor to adopt it; as he has himself, in more than one part of his treatise, insisted on the impossibility of neat cattle vomiting at all, on account of the formation of their intestines. Professor Camper has, indeed, seemed to contradict this opinion by the relation of a fact. For he declares that giving a decoction of camomile has made the beasts vomit. If that did happen, however, it cannot be supposed to be any other vomiting than the returning the fluid into the mouth from the cud-bag only, by the same action as the cud is brought back thither in order to rumination; which could have no effect towards forcing up bile. Whoever considers that the bile must pass through all the four stomachs in its way from the duodenum to the mouth, must be satisfied that it is next to an impossibility any such thing should happen. It is most rational to believe that if a discharge from the mouth of any thing resembling bile, on a slight inspection, has been observed, it was only of some yellow cud mixed with a large proportion of fluid, and mistaken for bile in default of stricter examination.

therefore, be called primary; the second displaying not only a further extension of such symptoms, but those others also that are caused by the general depravity of the fluids, and the consequential disorder of the vital economy, which arise from the putrescence that prevails from the weak action of the solids in giving due motion to the fluids, and from the defect or perversion of the glandular secretions. In this advanced state of the disease, a final period is soon brought on, either by a salutary crisis or the death of the beast. The morbid matter falling on some particular parts, and the general depravity of the humour causing obstructions in others, topical inflammations and a general irritation follow; whence, necessarily, a fever rises in a greater or less degree. By this means the force of circulation is increased, so that, where the habit is strong, the natural ferments, being again revived by the accelerated motion of the fluids, prevail over that of the leven of the contagion; and the morbid matter is either thrown on the superficial parts, in case of great strength, where it forms eruptions and tumours; or discharged by the glands of the intestines, in case of a less degree of strength. This constitutes a salutary crisis, in consequence of which the beasts recover from the murrain, at least considered as an acute disease; though they sometimes die afterwards of the ulcerations or abscesses produced then by it in the brain, lungs, or other viscera. But if the natural strength be so defective that the irritation and consequential fever cannot produce a sufficient force of circulation to give due power to the vital ferments, the contagious leven and putrescence overcome them; and an excessive evacuation is made by the liver and the glands of the small guts, which exhausts the remains of that power on which animal action depends; while the external and weaker parts suffer a gangrene from the deposit of the morbid matter, and the want of due motion of the vitiated and putrid humours.

(*To be continued.*)

Fine Arts.

THE LUXEMBOURG GALLERY.—The gallery of modern pictures at the Luxembourg has recently been opened, after re-arrangement and cleansing. The new catalogue contains about sixty new entries, including a fine picture by the late animal and landscape painter—Troyon, presented to the nation by the mother of the artist. It is said that a *salle* in the same gallery is to be set apart in future for the works of foreign artists; and also for the pictures of French artists recently deceased, it being the practice to retain such works for five years after the death of the artist, and then to transfer them to the Louvre.

LA FONTAINE ILLUSTRATED BY DORE.—Gustave Doré, the eminent French artist, is about to illustrate La Fontaine's Fables, and a very charming work may be expected, for there is no question that the subject is far better suited to M. Doré's style than such grand themes as the *Inferno* of Dante. His illustrations of the Fairy Tales of Perault, and of the *Contes Drolatiques* of Balzac, may be cited as the most completely satisfactory emanations of his always-clever pencil. M. Doré is said to be at present a constant visitor to the Jardin des Plantes for the purpose of studying the habits and movements of animals. Rats play a grand part in the fables of the amiable La Fontaine, and M. Doré is said to have at home an interesting collection of rats, of all colours and ages, who have become quite tame, and exhibit their antics in the most amusing manner; these creatures will have the honour of acting as models for many of the figures in the fables.

Commerce.

TEA CULTIVATION IN CEYLON.—It appears by the *Colombo Observer* that great progress is now being made in this respect in Ceylon. It is said that the tea lands in the Himalayas alone are quite capable of producing ten times the whole amount of tea imported into England from all the other tea-growing countries in the world. "A considerable quantity of tea seed," says Dr. Thwaites in his official report on the subject, "has been distributed during the past year. The climate of Ceylon seems admirably adapted for the successful cultivation of tea. The plant grows well from the elevation of Peradenia (1,600 feet) to that of Hakgalla (5,000 feet), and it would no doubt thrive in situations somewhat higher than the latter; and, as there are extensive tracts of forest land in the island, too high for coffee but quite suitable for tea, it may reasonably be anticipated that the cultivation of the latter will at some future time assume large proportions. In view of such a contingency, and in order to secure the production of a larger quantity of seed than is at present procurable in the island, an addition is being made to the number of tea-plants now growing in this garden (Peradenia); a certain number have been planted out at Hakgalla; and several planters are, at my suggestion, forming small nurseries of tea upon their estates. When sowing tea seeds, it is of importance to know that, to ensure success, they should be perfectly fresh; for they will not germinate if they have been allowed to become dry."

Colonies.

NEW SOUTH WALES.—The estimates for the year 1866 have been laid before the Assembly. The total amount required for the year chargeable on revenue is £1,876,520, being an increase of £52,280 on the appropriation for last year. The increase is, however, principally due to the interest on debentures and Treasury bills exceeding that of the previous year, and the expenditure for the several departments is to be decreased by £41,766. There is also a supplementary estimate for 1865 of nearly £10,000. The estimates contain the following sums under the head of railways. Towards the extension of the Great Western line, £200,000; towards the extension of the Great Northern line, £400,000; towards relaying the line from Sydney to Parramatta Junction, £20,000; and for enlarging railway bridges at East Maitland. £4,000.

GOLD.—The total amount of gold exported from South Australia since the beginning of 1865 is 1,499,368 ounces, of which 142,540 were transhipped from New Zealand. During the corresponding period of the previous year the entire quantity was 1,581,731 ozs., and of this total 201,122 ozs. were from New Zealand. The imports of specie during October amounted to £125,000, in gold £300. The specie exported amounted to £34,296. The quantity of silver bullion exported was 2,476 ozs. 10 dwts.

Notes.

THE STATE OF THE STREETS OF LONDON.—At a meeting of the Commissioners of Sewers of the City on Tuesday, the 16th inst., among the business that was to be transacted was the hearing of summonses that had been taken out by the inspectors of the commissioners against the contractors for cleansing the streets of the City, for having neglected their duty in that respect on the occasion of the great snow storm on the 11th of January. The wretched state of the streets was fully established, not only by the evidence of the inspectors, but by the testimony of many of the commissioners themselves, and it was proved in several cases that there had been no endeavour made to remove the mass of snow and filth that had accumulated. The defence was that the storm had come on so suddenly that the contractors

were unable to obtain men to do what was required, but the commissioners considered there had been a neglect of duty, for which they imposed a fine of £2 in the case of every street where that neglect had occurred. The total amount of the fines thus levied was £200.

A SILENT POKER.—In the last number of the *Journal* a "silent coal-scuttle" was recommended for invalids; the fireplace will be complete if a common walking-stick or soft bar of wood be used as a poker—it makes very little noise, either when used or when laid down. In many sick chambers the advantage of this poker has been fully appreciated, and this simple article of comfort to invalids cannot be too widely made known.

PUBLIC REGISTER OF APARTMENTS TO LET.—The municipality of Paris has established registers of lodgings to let at each of the twenty mairies, or offices of the mayors, in the city. The register is an immense volume, placed on a stand in the vestibule of the building, and the entries are under the heads of the twenty arrondisements. The idea is an excellent one, the only doubt is whether it will be the special business of anyone to see that as soon as any apartment is let, it shall be erased from the register, otherwise in a very short time the mass of entries will not only become enormous, but deceptive. If the owners of apartments attend to their own interests, they will aid in perfecting so useful a public register.

THE PARIS ACADEMY OF SCIENCES has just received a handsome bequest by the will of a gentleman named Plumet, who has bequeathed twenty-five shares in the Bank of France, each worth about one hundred and fifty pounds, to establish a certain number of annual prizes.

MEETINGS FOR THE ENSUING WEEK.

MON.....R. Geographical, 8½. 1. Mr. James Martin, "Explorations in N.W. Australia." 2. Mr. James Jardine, "Description of Cape York District, Australia."
Entomological, 7. Annual Meeting.
Society of Arts, 8. Cantor Lecture. Mr. G. W. Hastings, "On Limited Liability." (Lecture IV.)
Medical, 8½. Lettsomian Lecture. Dr. Anstie.

TUES.....Medical and Chirurgical, 8½.
Civil Engineers, 8. Continued Discussion upon Mr. Grant's Paper, "On the Strength of Cement;" and (time permitting) Mr. W. H. Mills, "On the Craigellachie Viaduct."
Zoological, 8½.
Ethnological, 8. 1. Sir E. W. Belcher, "Remarks on the Andaman Islands, from the Notes of Lieut. St. John." 2. Dr. Caddy, "Visit to the Patagonians."
Royal Inst., 3. Professor Tyndall, "On Heat."

WED.....Society of Arts, 8. Lord Henry G. Lennox, M.P., "On the Uses of National Museums to Local Institutions."
Geological, 8. 1. Mr. R. A. C. Godwin-Austen, "Notes on Belgian Geology." 2. Mr. W. T. Locke Travers, "On the Origin of certain Lake-basins in New Zealand." Communicated by Sir C. Lyell, Bart.
R. Society of Literature, 8½.
Archæological Assoc., 8½.

THURS...Royal, 8½.
Antiquaries, 8½.
Philosophical Club, 6.
Royal Inst., 3. Prof. Tyndall, "On Heat."

FRI.....Royal Inst., 8. Mr. S. W. Baker, "On the Sources of the Nile."

SAT .....Royal Inst., 3. Prof. Westmacott, R.A., "On Art Education, and how Works of Art should be viewed."

Patents.

From Commissioners of Patents' Journal, January 12th.

GRANTS OF PROVISIONAL PROTECTION.

Air in rooms, cooling and purifying—3292—W. Clark.
Astronomical instruments—3316—W. E. Newton.
Bolts and rivets—3215—A. V. Newton.
Boot and shoe soles of leather, cutting and rounding—2916—N.H.Felt.
Boots and shoes—3371—J. Hall.
Bottles, stoppers for—3—N. Thompson.
Carriages, axles for—3336—E., J. C., and J. Lones, J. and T. Brettell, and C. Vernon.
Charged cartridge cases, closing—3379—G. Hawksley.
Chromates of ammonia and chromic acid, making—2702—W. Clark.
Coats, &c.—3157—W. Calvert and J. S. Robertson.
Copper, smelting—3267—H. C. Ensell.
Cotton bale tie or hoop lock—3361—W. E. Newton.
Cotton, &c., compressing—2837—J. J. McComb.
Dyeing fabrics, preparing dyes, and making yarns—3318—J.A.Cooper.
Fabrics passing through machinery, expanding—3375—W. Edleston and J. Schofield.
Fire-arms, cartridges for breech-loading—3304—W. E. Newton.
Fire-arms, repeating—3284—W. Clark.
Fire places for economically consuming fuel—25—B. Blackburn.
Fire-proof safes—3305—J. W. Blackman.
Furnaces—5—T. Prideaux.
Gas-burner—3303—G. Davies.
Gas, regulating heat obtained by—3268—H. Planck.
Grain, &c., treating—3344—G. C. A. D'Auxy.
Ivory and wood, compositions in imitation of—3310—M. D. Rosenthal and S. Gradenwitz.
Kamptulicon—11—C. Tayler, W. Dyer and H. and J. Dooley.
Labels, &c., damping and gumming—3343—J.Benn & G.O.Luckman.
Machinery, lubrication of—3342—J. Rea.
Materials, conveying of—21—W. Simons.
Peat, purifying oils produced from—3312—D. McGrath.
Piston and grease cup—3353—J. Bates, E. and E. W. Brookes.
Pumps—3330—H. D. Hoskold and W. B. Brain.
Railways, steel crossings for—3332—F. W. Webb.
Railway trains, signalling between passengers, guards, and engine drivers of—3176—R. Pickup and J. Heald.
Rudders—3367—J. R. Napier and W. J. M. Rankine.
Safes—3324—J. Groves and G. Robinson.
Ships, steering—7—J. Ashdown.
Shoeing horses with metal shoes without nails—3134—J. Sainty.
Signals—3381—J. S. Gisborne.
Soda—3340—M. Henry.
Stays, &c., and fastenings for same—3072—S. Dixon.
Steam boilers or generators—3369—A. Barclay.
Steam boilers, &c.—3338—J. Fisher.
Steam engines—3308—W. Clark.
Steering apparatus—3171—S. Clark.
Steps or stairs, treads of—3306—G. Hawksley.
Stereoscopes—3363—I. Baggs.
Strapping used in machinery, securing ends of—3302—W. Barnsley.
Suphurous and arsenical pyrites, treatment of—3256—C. Pengilly.
Telegraph cables, paying out and hauling in—3346—S. Griffith.
Telegraphic cables and conductors—3357—C. F. Varley.
Telegraphic inking and marking instruments—3008—C.H.Chadburn.
Textile fabrics, finishing—9—W. H. Norrie.
Textile matters, applying mineral soda to the scouring of—3107—L. J. Bouchart.
Throstle machines and flys—3377—T. Parkinson.
Trimmings—3320—W. Smith.
Vehicles and ships, propelling—2493—D. Spink.
Vessels, side propellers for—3373—B. Burchall.
Watches, winding keyless—3236—A. Guye.
Weaving, looms for—3365—J. J. and E. Harrison.
Window sashes, hanging—3326—R. M. Marygold and S. Fitzjohn.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Carpets, &c, fabrics for—72—H. Hutchinson.
Hides or skins, tanning—33—W. H. Towers.
Wool, detergent for cleansing—65—J. H. Johnson.

PATENTS SEALED.

1857. R. V. Tuson.
1865. J. Thornton.
1867. J. Armitage.
1871. W. A. Richards.
1874. J. E. F. Ludeke.
1882. D. Caddick.
1887. T. H. Ince.
1889. W. Tranter.
1893. R. C. Bristol.
1896. A. V. Newton.
1919. J. McG. Croft.
2031. A. V. Newton.
2081. P. C. Kjellberg.
2440. G. E. and E. L. Rolland.
2463. C. M. Kernot & N. Symons.
2585. H. A. Bonneville.
2727. J. W. Lea.
2942. L. A. Velu, and F. E. and L. E. A. Fosse.

From Commissioners of Patents Journal, January 16th.

PATENTS SEALED.

1888. C. Rosson.
1891. H. A. Clum.
1894. W. la Penotière.
1895. R. Smyth and W. E. Evans.
1899. St. J. V. Day.
1903. R. M. Wanzer.
1904. A. Smith.
1905. J. H. Chaudet.
1914. J. P. Gillard.
1915. M. P. W. Boulton.
1937. J. Bélicard, jun.
1963. B. Latham & R. Campbell.
1974. A. Y. Rehm.
2016. W. H. Preece.
2068. J.W. Sumner & C. A.Scott.
2079. W. E. Newton.
2149. W. E. Newton.
2178. W. E. Newton.
2186. G. Owen.
2757. A. Krupp.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

157. E. Sabel.
120. G. A. Biddell.
176. S. Blackwell.
217. W. Allen and W. Johnson.
256. W. Clark.
118. J. S. Butler.
123. E. Morewood.
145. L. Verdure.
151. J. Lightfoot.
347. C. Parigot and A. Grivel.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

147. W. Newman.
133. W. Betts.
153. R. Garrett, jun., and J. Kerridge.
95. J. Gibbons.
113. J. J. Stevens.
114. F. J. Manceaux and E. N. Vieillard.
126. J. Dauglish.
124. W. Craft and T. Wilson.